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AN ANNOTATED BIBLIOGRAPHY ON THE BIOLOGY OF PACIFIC TUNAS

BY BELL M. SHIMADA

FISHERY BULLETIN 58

UNITED STATES DEPARTMENT OF THE INTERIOR, Oscar L. Chapman, *Secretary*

FISH AND WILDLIFE SERVICE, Albert M. Day, *Director*

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ABSTRACT

With the initiation of studies of the biology, ecology, and behavior of Pacific tunas by the Pacific Oceanic Fishery Investigations, U. S. Fish and Wildlife Service, in the Hawaiian Islands in 1948 the need for a current systematic compilation of scientific papers dealing with the biology of Pacific tunas became pressing. This bibliography was prepared for the use of the biologists and technicians working in the Investigations as well as for tuna researchers in general, and contains many references to Japanese research, the results of which have hitherto not been generally available outside Japan.

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AN ANNOTATED BIBLIOGRAPHY ON THE BIOLOGY OF PACIFIC TUNAS

By Bell M. Shimada, *Fishery Research Biologist*

Studies were begun in 1948 by the Pacific Oceanic Fishery Investigations of the U. S. Fish and Wildlife Service to gather fundamental data on the life histories, ecology, and behavior of the various species of Pacific tunas. Early in the planning of the research program conducted from the Hawaiian Islands, it was recognized that review and systematic compilation of the literature on these subjects were essential to the effective guidance of the projected research. The principal reference work available was the bibliography of the tunas prepared some 20 years ago by Genevieve Corwin (see Corwin 1930, in the Bibliography, p. 5). To meet the needs of the workers in the Investigations, and to assist tuna researchers in general, the preparation of this bibliography was undertaken.

The bibliography deals chiefly with the black skipjacks or little tunnies (*Euthynnus alletteratus*, *E. lineatus*, and *E. yaito*), the oceanic or common skipjack (*Katsuwonus pelamis*), the albacore (*Thunnus germo*), the bluefin or black tunas (*Thunnus maccoyi*, *T. orientalis*, and *T. thynnus*), the big-eyed tunas (*Parathunnus mebachi* and *P. sibi*), the yellowfin tuna (*Neothunnus macropterus*), and the frigate mackerels of the genus *Auxis*. Synonymous and related species reported from the Pacific Ocean are included. Waters contiguous to the Indo-Australian Archipelago have been considered as a part of the Pacific Ocean proper, inasmuch as many of the important studies of tuna species occurring in the Pacific Ocean were based on data gathered in that region.

In the review of the literature, some preliminary work was done at Stanford University, Palo Alto, and at the California Academy of Sciences, San Francisco, California. The libraries of the Bernice Pauahi Bishop Museum, the University of Hawaii, and the Territorial Board of Agriculture and Forestry in Honolulu, and private collections of staff members of the Investigations were particularly productive of material. The Japanese references were gathered by a reconnaissance team in Japan from November 1948 to July 1949 investigating the results of Japanese tuna research. Search of private and public libraries in and about Tokyo supplied much material that has not hitherto been generally available outside Japan. Some references found in Corwin's bibliography could not be examined at first hand; these are included here, as given by Corwin, with a notation to show their source.

The general style used by Corwin has been followed in cataloging and annotating the material. The arrangement of the references is by authors listed alphabetically. Entry is made only under the senior author's name if there is more than one author; the abbreviation "et al." is used with the senior author's name to show collaboration of more than three authors. Each author's works are listed chronologically by year of publication, and those published in the same year are given in alphabetical sequence. Generally, pagination is given only for the parts of the publication falling within the scope of the bibliography.

Appropriate notations in the bibliography distinguish those papers published only in Japanese, those published in Japan but written in English, and those published in Japanese with an English abstract. Translations were made of Japanese titles when English equivalents were not given.

Brief annotations of the publications are included except for those that could not be consulted and for those whose titles give a clear indication of the contents. The scientific nomenclature used by each author is followed in the annotations; appropriate cross references to synonymous names regarded as having priority appear in the Index. Where both vernacular and scientific names of the tuna were given, the scientific nomenclature is retained.

The preparation of the Index presented considerable difficulty owing to the confused state of the

taxonomy of the various species of tuna. As the relationships of the tuna species of the Pacific, and for that matter the world in general, have not been clearly defined, specific names of questionable validity have been arbitrarily indexed as separate entries. For example, *Neothunnus itosibi* is regarded by some workers as a form distinct from *Neothunnus macropterus*, while others consider the two to be synonymous. References to *Neothunnus itosibi* and *Neothunnus macropterus*, therefore, have been treated separately. Synonyms which are generally accepted as applying to one given species, such as *Euthynnus pelamis* for *Katsuwonus pelamis*, have been indexed under the name which is believed to have priority, with appropriate cross reference under the synonymous name. The same procedure was used in indexing names which differ slightly in spelling. Again, it should be pointed out that the indexing of these scientific names is to a large degree arbitrary, and is not an attempt to clarify the systematics of the tunas.

A list of abbreviations of the various publications cited and of the English translations of titles of Japanese periodicals as used in the bibliography is included.

Acknowledgment is made of the valuable assistance and advice given the author by various individuals and organizations. Especially is credit due the Fisheries Division, Natural Resources Section, General Headquarters, Supreme Commander for the Allied Powers, under W. C. Herrington, Drs. K. Kuronuma and Y. Hiyama, and other Japanese scientists, and Dr. J. G. F. Hardenburg of Batavia, Java, for their generous cooperation. The author is also indebted to the library staffs of Stanford University, the California Academy of Sciences, University of Hawaii, and the Bernice Pauahi Bishop Museum, and to Vernon Brock of the Division of Fish and Game, Board of Agriculture and Forestry, Territory of Hawaii, and staff members of the Pacific Oceanic Fishery Investigations, who contributed materially to the preparation of this bibliography.

ANNOTATED BIBLIOGRAPHY

Explanation of symbols

[C] = references listed by Corwin (see Corwin 1930, p. 5) that could not be verified.
[J] = published in Japanese only.
[JE] = published in Japan but written in English.
[Je] = written in Japanese with English abstract.
[P] = accession to the library of the Pacific Oceanic Fishery Investigations.

[For an explanation of the abbreviation see ltst, p. 25]

ABE, TOKIHARU.

1939. A list of the fishes of the Palao Islands. Palao Trop. Biol. Sta. Studies, No. 4, p. 567. [JE] [P]
Germo macropterus, Katsuwonus pelamys, Thunnus thynnus: recorded; distribution.

AIKAWA, HIROAKI.

1933. Fishery conditions on the Pacific Coast for skipjack, tuna, and sauries. Proc. Sci. Fish. Assoc., vol. 5, No. 4, pp. 354–369. [J] [P]
Albacore, big-eyed tuna, black tuna, skipjack, yellowfin tuna: fishing conditions correlated with surface water temperature.

1937. Notes on the shoal of bonito along the Pacific Coast of Japan. Bull. Japanese Soc. Sci. Fish., vol. 6, No. 1, pp. 13–21. [Je] [P]
Age analysis and size composition of skipjack catches; stock and population relationships; use of condition factor in separating migratory and nonmigratory fish.

AIKAWA, HIROAKI, and MASAO KATO.

1938. Age determination of fish. I. Bull. Japanese Soc. Sci. Fish., vol. 7, No. 2, pp. 79–88. [Je] [P]
Germo germo, Katsuwonus vagans, Neothunnus macropterus, Thunnus orientalis: age analysis using vertebrae; age composition of commercial catch; calculated length and weight groups; body condition; growth rate; morphometric data.

ANONYMOUS.

1938. Status of the investigation of tuna longline fishing grounds in the South China Sea. Formosa Fish. Mag., No. 279, pp. 10–19. [J]
Albacore, yellowfin tuna: body temperatures; distribution; length-weight data; sexual maturity; stomach contents; figured.

1939. Marked fish. Semi-Ann. Rpt. Oceanogr. Invest., No. 65, p. 137. [J]
Skipjack: Japan; release records of tagged fish.

1941. Pacific skipjack indigenous to Sulu Sea. South Sea Fish., vol. 7, No. 5, p. 55. [J] [P]
Distributional note.

ASANO, NAGAO.

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South Seas; stomach contents; *Auxis* sp. recorded as food.

BAN, YOSHINORI.

1941. Search for southern tuna fishing grounds. South Sea Fish., vol. 7, No. 9, pp. 10–21. [J] [P]
Yellowfin tuna: South Seas; fishing conditions correlated with oceanography; stomach contents; age analysis; sexual maturity.

BARNHART, PERCY.

1936. Marine fishes of Southern California. Univ. California Press, Berkeley, pp. 36–37.
Auxis thazard, Katsuwonus pelamis, Germo alalunga, Neothunnus macropterus, Thunnus thynnus: description; distribution; English common names; figures.

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1840. Narrative of a whaling voyage around the globe, from the year 1833 to 1836. Vol. 2, pp. 278–282. London.
Scomber germo: description; anatomy of reproductive system; food; enemies. *Scomber pelamys:* description; parasites.

BERG, LEO S.

1947. Classification of fishes both recent and fossil. J. W. Edwards Co., Ann Arbor, pp. 491–492.
Anatomy and classification of Thunniformes (Plecostei).

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1844. Bijdragen tot de geneeskundige topographie van Batavia. Generisch overzicht der fauna. Nat. Geneesk. Arch. Neerland's Indië, vol. 1, p. 553.
Thynnus: recorded.

1845. Bijdragen tot de geneeskundige topographie van Batavia. Generisch overzicht der Fauna. Nat. Geneesk. Arch. Neerland's Indië, vol. 2, p. 516.
Auxis taso: recorded.

1850. Bijdrage tot de kennis der ichthyologische fauna van Midden-en Oost-Java, met beschrijving van eenige nieuwe species. Verh. Batavia Genoot. Kunst. Wetens., vol. 23, p. 8.
Auxis taso: recorded.

1852. Bijdrage tot de kennis der makreelachtige visschen van den Soenda–Molukschen Archipel. Verh. Batavia Genoot. Kunst. Wetens., vol. 24, pp. 36–37, 89.
Thynnus macropterus, T. thunnina, and *T. tonggol:* recorded from Dutch East Indies; description and synonymy of *T. tonggol.*

BLEEKER, PIETER—Continued

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Auxis tapeinosoma: recorded and described.

1855. Vijfde bijdrage tot de kennis der ichthyologische fauna van Ternate. Nat. Tijdschr. Nederlandsch-Indie, vol. 8, pp. 301–302.
Auxis thynnoides: recorded; description; compared with *A. tapeinosoma*, *A. taso*, and *A. vulgaris*.

1856. Beschrijvingen van nieuwe en weinig bekende vischsoorten van Amboina, versameld op eene reis door den Molukschen Archipel, gedaan in het gevolg van den Gouverneur-Generaal Duymaer van Twist in September en October 1855. Act. Soc. Sci. Indo-Neerlandicae, vol. 1, pp. 41–42.
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Thynnus pelamys, T. thunnina: recorded from the Dutch East Indies.

1860b. Dertiende bijdrage tot de kennis der vischfauna van Celebes. Visschen van Bonthain, Badjoa, Sindjai, Lagoesi en Pompenoea. Act. Soc. Sci. Indo-Neerlandicae, vol. 8, p. 38. [C]
Thunnus thunnina: recorded from Dutch East Indies.

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Thynnus affinis: recorded from Dutch East Indies.

1861b. Mededeeling omtrent vischsoorten, nieuw voor de kennis der fauna van Singapoera. Versl. Akad. Amsterdam, vol. 12, p. 52. [C]
Thynnus thunnina, T. tonggol: recorded from Singapore.

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Auxis thynnoides, Pelamys macropterus, P. pelamys, P. thunnina: recorded.

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Thynnus thunnina: recorded.

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Japan; albacore and skipjack fishing conditions correlated with water temperature.

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Japan; skipjack catch correlated with water temperature.

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Population studies based on comparisons of body proportions, counts of meristic characters, and sexual maturity.

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1892. The fishes of San Diego, California. Proc. U. S. Natl. Mus., vol. 15, No. 897, pp. 130, 147.

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KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION.

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Ryukyu Islands; skipjack fishing conditions correlated with water temperature; length-weight, girth data.

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1926b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1924, pp. 52–66. [J] [P]

Big-eyed tuna, skipjack, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1927a. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Sta. for 1925, pp. 38–53. [J] [P]

Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1927b. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1925, pp. 1–38. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature and currents; length-weight and girth data; records and descriptions of scombroid juveniles (also reported in Kishinouye 1926).

1928a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1926, pp. 1–22. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature and currents; length-weight and girth data; release records of tagged fish.

1928b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1926, pp. 22–37. [J] [P]

Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION—Continued

1929a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1927, pp. 1–20. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature; length-weight and girth data.

1929b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1927, pp. 20–34. [J] [P]

Big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1930a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1928, pp. 1–18. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature.

1930b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1928, pp. 18–31. [J] [P]

Albacore, big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1930c. Experimental fishing by small motor vessels: Experimental longline fishing for albacore. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1928, pp. 54–60. [J] [P]

Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1931a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1929, pp. 1–16. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature.

1931b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1929, pp. 16–30. [J] [P]

Albacore, big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1932a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1930, pp. 1–20. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature.

1932b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1930, pp. 21–28. [J] [P]

Albacore, big-eyed tuna, black tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1932c. Experimental longline fishing for albacore and pole and line fishing for mackerel. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1930, pp. 54–59. [J] [P]

Ryukyu Islands; albacore catch correlated with water temperature.

KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION—Continued

1933a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1931, pp. 1–16. [J] [P]

Ryukyu Islands, Philippine region; skipjack fishing conditions correlated with water temperature.

1933b. Experimental longline fishing for tuna. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1931, pp. 16–23. [J] [P]

Albacore, big-eyed tuna, yellowfin tuna: Ryukyu Islands; catches correlated with water temperature.

1935. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1933, pp. 1–12. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature.

1936a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1934, pp. 1–16. [J] [P]

Ryukyu Islands; skipjack fishing conditions correlated with water temperature; length-weight data.

1936b. Investigation of the migration of important fishes. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1934, pp. 86–87. [J] [P]

Ryukyu Islands; release records of tagged skipjack.

1937. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1935, pp. 1–8. [J] [P]

Ryukyu Islands; skipjack catch correlated with water temperature; length-weight data; size composition of catch.

1938a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1936, pp. 1–4. [J] [P]

Ryukyu Islands; skipjack length-weight data.

1938b. Investigation of the migration of important fishes. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1936, p. 89. [J] [P]

Ryukyu Islands; release records of tagged skipjack.

1939a. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1937, pp. 1–3. [J] [P]

Ryukyu Islands; skipjack length-weight data.

1939b. Investigation of the migration of important fishes. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1937, p. 69. [J] [P]

Ryukyu Islands; release records of tagged skipjack.

1940a. Experimental skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1938, pp. 1–3. [J] [P]

Ryukyu Islands; skipjack length-weight data.

1940b. Investigation of the migration of important fishes. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1938, p. 43. [J] [P]

Ryukyu Islands; release records of tagged skipjack.

KAGOSHIMA PREFECTURAL FISHERIES EXPERIMENT STATION—Continued

1941. Investigation of skipjack fishing. Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta. for 1939, pp. 1–3. [J] [P]

Ryukyu Islands; skipjack length-weight data.

KANAMURA, MASAMI, and KAKUJI IMAIZUMI.

1935. Report on experimental fishing by the Shonan Maru in 1935: Report of experimental longline fishing for tuna in eastern Formosan waters. Formosa Govt.-Gen. Fish. Expt. Sta. Publ., No. 3, pp. 165–202. [J] [P]

Big-eyed tuna, yellowfin tuna: length-weight data; body temperatures; sexual maturity; catch per unit of effort; fishing conditions in relation to oceanography and weather; distribution.

KANAMURA, MASAMI, and HARUO YAZAKI.

1940a. Report on experimental fishing by the Shonan Maru in 1937: Investigation of tuna longline fishing grounds in the East Philippine Sea. Formosa Govt.-Gen. Fish. Expt. Sta. Publ., No. 21, pp. 1–65. [J] [P]

Albacore, big-eyed tuna, skipjack, yellowfin tuna: catch per unit of effort; distribution of yellowfin, big-eyed tuna, and skipjack; yellowfin tuna: stomach contents; body temperature and relation to water temperature; length-weight data; body condition; age analysis; sexual maturity; fishing conditions in relation to oceanography and weather.

1940b. Report of the investigation of fishing grounds by the Shonan Maru in 1937: Investigation of tuna longline fishing grounds in the South China Sea. Formosa Govt.-Gen. Fish. Expt. Sta. Publ., No. 21, pp. 67–117. [J] [P]

Albacore, skipjack, yellowfin tuna: distribution; catch per unit of effort; fishing conditions in relation to oceanography and weather; albacore, yellowfin tuna: stomach contents; body temperature; length-weight data; body condition; age analysis; sexual maturity.

KATO, GENJI.

1940. An account of longline fishing for tuna. South Sea Fish. News, vol. 4, No. 7, pp. 8–10. [J] [P]

Sexual maturity of yellowfin tuna noted.

KAWAMURA, HYŌZŌ.

1939. Observations on oceanography and fishing conditions in Palau waters. South Sea Fish. News, vol. 3, No. 1, pp. 2–6. [J] [P]

Fishing conditions for yellowfin tuna and skipjack correlated with oceanography.

KAWANA, TAKESHI.

1934. Tuna fishing in relation to oceanographic conditions. Prog. Rpt. Hokkaido Fish. Expt. Sta., vol. 31, pp. 1–180. [J] [P]

Thynnus orientalis: Japan; fishing conditions correlated with astronomical and oceanographic factors; tagging; size composition of commercial catch.

1937. The catch of tunny, *Thunnus orientalis* T. and S., off Kushiro, Hokkaido, in relation to the vertical difference in water temperature. Bull. Japanese Soc. Sci. Fish., vol. 6, No. 2, pp. 73–74. [JE] [P]

KIDA, TAKEO.

1936. On the surface temperature of water in the tunny fishing grounds off Kushiro and Urakawa in summer. Bull. Japanese Soc. Sci. Fish., vol. 5, No. 2, pp. 87–90. [JE]

Thynnus thynnus: fishing conditions correlated with water temperature; size composition of schools; habits.

KIMURA, KINOSUKE.

1932. Growth curves of blue-fin tuna and yellow-fin tuna based on the catches near Sigedera, on the west coast of Prov. Idu. Bull. Japanese Soc. Sci. Fish., vol. 1, No. 1, pp. 1–4. [Je] [P]

Neothunnus macropterus, Thunnus orientalis: growth rates determined from size groups.

1935. Statistical analysis of the catch by keddle nets, along the coast of Surugu Bay. Rec. Oceanogr. Works, vol. 7, No. 1, pp. 1–36. [JE]

Growth of *Neothunnus macropterus;* age and size groups of *Thunnus orientalis.*

1941. Skipjack fishing. Fish. Technol. Lect. Ser., No. 4, 36 pp. [J]

Pacific Ocean; distribution; migration; catch correlated with water temperature; age and size composition of commercial catches.

1942a. Tuna and spearfish fishing conditions. Fish. Technol. Lect. Ser., No. 5, 122 pp. [J]

Albacore, big-eyed tuna, yellowfin tuna: Japan, Indo-Pacific region, South Seas; fishing conditions correlated with water temperature; age and size composition of albacore and yellowfin tuna.

1942b. Oceanic resources: Offshore fisheries. Sci. Sea, vol. 2, No. 3, pp. 142–147. [J] [P]

Albacore, black tuna, skipjack: Pacific Ocean; distribution; migration; distribution of big-eyed tuna and yellowfin tuna.

1949. Atlas of skipjack fishing grounds—with data on the albacore grounds. Kuroshio Publ. Co., Tokyo, 44 pp. [J]

Japan; catches of albacore and skipjack correlated with surface water temperature.

KIMURA, KINOSUKE, and KAZUMI ISHII.

1933. Statistical analysis of the catch at the northeastern end of Surugu Bay. Bull. Japanese Soc. Sci. Fish., vol. 2, No. 2, pp. 69–79. [Je]

Catches of yellowfin tuna correlated with water temperature.

KISHINOUYE, KAMAKICHI.

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1915a. Studies on the mackerels, cybiids, and tunas. Proc. Sci. Fish. Assoc., vol. 1, No. 1, pp. 1–24. [J] [P]

Auxis hira n. sp., *A. maru* n. sp., *Euthynnus yaito* n. sp., *Katsuwonus pelamys* n. sp., *Thunnus alalunga, T. macropterus, T. mebachi* n. sp., *T. orientalis, T. rarus* n. sp.: internal anatomy; classification; description; distribution; keys; Japanese common names; figures; spawning of *T. orientalis* and *A. maru;* food and habits of tunas in general.

KISHINOUYE, KAMAKICHI—Continued

1915b. Anatomical aspects of dark muscle. Proc. Sci. Fish. Assoc., vol. 1, No. 2, pp. 128–136. [J] [P]
Albacore, big-eyed tuna, black skipjack, black tuna, frigate mackerel, *Neothunnus rarus*, skipjack, yellowfin tuna: anatomy and vascular system of lateral musculature described; figured in part for all except big-eyed tuna and *N. rarus*.

1917a. A new order of the Teleostomi. Proc. Sci. Fish. Assoc., vol. 2, No. 2, pp. 1–4. [J] [P]
Classification; description of internal anatomy of order Plecostei and families Thunnidae and Katsuwonidae.

1917b. The food of tunas. Proc. Sci. Fish. Assoc., vol. 2, No. 1, pp. 106–108. [J] [P]
Albacore, big-eyed tuna, skipjack, yellowfin tuna: stomach contents; juvenile albacore, big-eyed tuna, skipjack, and *Auxis maru* recorded from stomachs of adults.

1918. Amount of blood in the dark muscle and other muscles of the Plecostei. Proc. Sci. Fish. Assoc., vol. 2, No. 3, pp. 259–260. [J] [P]
Blood content of dark lateral muscle of big-eyed tuna and skipjack compared.

1919a. Studies on the Plecostei. Proc. Sci. Fish. Assoc., vol. 2, No. 4, pp. 269–274. [J] [P]
Evolution of various tuna species based on internal anatomy; vascular system and anatomy of lateral musculature of Thunnidae and Katsuwonidae; and vascular plexuses of albacore, big-eyed tuna, black skipjack, black tuna, frigate mackerel, skipjack, and yellowfin tuna figured.

1919b. The larval and juvenile stages of the Plecostei. Proc. Sci. Fish. Assoc., vol. 3, No. 2, pp. 49–53. [J] [P]
Black skipjack, black tuna, skipjack: western Pacific; juveniles recorded and described; markings of young Scombroid fishes mentioned; Lütken's "albacore" juveniles and Günther's "black skipjack" juvenile described and figured.

1919c. Black skipjack from Mexico. Proc. Sci. Fish. Assoc., vol. 3, No. 2, p. 113. [J] [P]
Euthynnus lineatus: Mexico; recorded and described as a new species.

1921. Tunas of the American coast. Proc. Sci. Fish. Assoc., vol. 3, No. 3, p. 239. [J] [P]
Anatomical differences between American bluefin tuna and Japanese black tuna noted.

1922a. Air bladders of Thunnidae. Proc. Sci. Fish. Assoc., vol. 3, No. 4, p. 304. [J] [P]
Albacore, big-eyed tuna, yellowfin tuna: air-bladders described; recorded and described for black tuna.

1922b. Carangid-like markings of skipjack. Proc. Sci. Fish. Assoc., vol. 3, No. 4, pp. 304–305. [J] [P]
Unusual markings on one specimen recorded and described.

1922c. Black skipjack also found in Japan Sea. Proc. Sci. Fish. Assoc., vol. 3, No. 4, p. 305. [J] [P]
Distribution record.

KISHINOUYE, KAMAKICHI—Continued

1923. Contributions to the comparative study of the so-called Scombroid fishes. Jour. Coll. Agr., Imp. Univ. Tokyo, vol. 8, No. 3, pp. 293–475. [P]
Auxis hira, A. maru, Euthynnus lineatus, E. yaito, Katsuwonus pelamis, Neothunnus macropterus, N. rarus, Parathunnus mebachi, Thunnus germo, T. orientalis: anatomy; bibliography; classification; description; distribution; figures; food; habits; keys; Japanese common names; synonymy; growth of *N. macropterus, T. germo, T. orientalis;* enemies of *T. orientalis;* migration of *K. pelamis, T. germo, T. orientalis;* parasites of *E. yaito, K. pelamis, N. macropterus, P. mebachi;* spawning of *E. yaito, K. pelamis, N. macropterus, T. orientalis;* young of *A. maru, E. yaito, K. pelamis, T. germo, T. orientalis.*

1924. Observations on skipjack fishing grounds. Proc. Sci. Fish. Assoc., vol. 4, No. 2, pp. 87–92. [J] [P]
Auxis maru, Euthynnus yaito, Katsuwonus pelamis, ?Neothunnus macropterus: Ryukyu Islands; records and descriptions of juveniles.

1926. An outline of studies of the Plecostei (tuna and skipjack) in 1925. Proc. Sci. Fish. Assoc., vol. 4, No. 3, pp. 125–137. [J] [P]
Auxis sp., *Katsuwonus pelamis, ?Neothunnus macropterus, ?Parathunnus mebachi:* Ryukyu Islands; juveniles recorded, described, and figured.

KITAHARA, T.

1897. Scombridae of Japan. Jour. Imp. Fish. Bur., Tokyo, vol. 6, pp. 1–3. [C]
Thynnus germo, T. macropterus, T. pelamys, T. sibi, T. thunnina, T. thynnus: figures.

KŌCHI PREFECTURAL FISHERIES EXPERIMENT STATION.

1923a. Oceanographic observations and search for skipjack fishing grounds. Prog. Rpt. Kōchi Pref. Fish. Expt. Sta. for 1921, pp. 1–4. [J] [P]
Japan; skipjack fishing conditions correlated with oceanographic factors.

1923b. Oceanographic observations and search for tuna fishing grounds. Prog. Rpt. Kōchi Pref. Fish. Expt. Sta. for 1921, pp. 5–15. [J] [P]
Albacore, big-eyed tuna, yellowfin tuna: Japan; migration; vertical distribution.

1924. Oceanographic observations and search for tuna fishing grounds. Prog. Rpt. Kōchi Pref. Fish. Expt. Sta. for 1922, pp. 39–49. [J] [P]
Albacore, big-eyed tuna, black tuna, yellowfin tuna: Japan; migration; vertical distribution.

KODAMA, MASAHARU, KIYOSHI IIZUKA, and TOSHI HARADA.

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Skipjack and tuna examined.

KUMAMOTO PREFECTURAL FISHERIES EXPERIMENT STATION.

1946. Experimental pole and line fishing for skipjack. Prog. Rpt. Kumamoto Pref. Fish. Expt. Sta. for 1942, 1943, 1944, pp. 3–5. [J] [P]
Ryukyu Islands; skipjack fishing conditions correlated with water temperature.

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Katsuwonus vagans, Neothunnus macropterus, Parathunnus mebachi: distribution; English and Japanese common names; figures; Dutch and Malayan common names of *N. macropterus* and *P. mebachi.*

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1940. A young of ocean sunfish, *Mola mola*, taken from the stomach of *Germo germo*, and a specimen of *Masturus lanceolatus* as the second record from Japanese waters. Bull. Biogeog. Soc. Japan, vol. 10, No. 2, pp. 25–28. [JE]
Stomach contents of *Germo germo* noted.

LACÉPÈDE, BERNARD GERMAINE ÉTIENNE.
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Thynnus vagans: description; distribution; figured.

LORD, CLIVE.
1927. A list of the fishes of Tasmania. Jour. Pan-Pacific Res. Inst., vol. 2, No. 4, p. 15.
Auxis thazard, Thunnus maccoyi: listed.

LÜTKEN, CHRISTIAN FREDERICK.
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MACLEAY, WILLIAM.
1881. Descriptive catalogue of Australian fishes, vol. 1, pp. 191–192. Sydney. [C]
Thynnus affinis, T. maccoyi, T. pelamys: description; distribution.

MANTER, HAROLD W.
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Gymnosarda alletterata and *G. pelamis* listed as hosts.

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1948. Observations on the spawning of oceanic skipjack (*Katsuwonus pelamis*) and yellowfin tuna (*Neothunnus macropterus*) in the Northern Marshall Islands. U. S. Fish and Wildlife Serv. Fish. Bull., vol. 51, No. 44, pp. 201–206.
Katsuwonus pelamis: Marshall Islands; records and descriptions of juveniles; ova measurements. *K. pelamis, Neothunnus macropterus:* spawning; length, sex, maturity data.

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Katsuwonus pelamis, Neothunnus itosibi, N. macropterus: listed in commercial catch.

MARUKAWA, HISATOSHI.
1939. Fisheries of the South Sea Islands: Natural food of skipjack and tunas. South Sea Fish., vol. 5, No. 7, pp. 12–14. [J] [P]
Yellowfin tuna: stomach contents; juveniles of *Auxis thazard, Katsuwonus pelamis*, and *Parathunnus sibi* mentioned as food of tunas.

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Albacore, big-eyed tuna, black tuna, yellowfin tuna: South Seas; distribution; yellowfin tuna: description; skipjack: distribution; migration; sexual maturity in Indo-Pacific region; size difference between South Seas and Japanese skipjack.

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Gonad weight used as a criterion of sexual maturity; gonads figured.

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Release of tagged skipjack recorded; migration.

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1922. Check list of the fishes and fish-like animals of New South Wales, Part III. Australian Zool., vol. 2, pt. 3, pp. 104–105.
Auxis ramsayi, A. thazard, Euthynnus alletterata, E. pelamis, Thunnus germo, T. maccoyi: listed; synonymy; key; figures of *A. thazard, E. pelamis*, and *T. maccoyi.*

MEEK, SETH E., and SAMUEL F. HILDEBRAND.
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Auxis thazard, Germo alalunga, Gymnosarda alleterata, G. pelamis, Thunnus thynnus: description; distribution; key; synonymy.

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Germo alalunga, Thunnus thunnus: recorded.

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Japan; skipjack fishing conditions correlated with water temperatures and specific gravity.

1930b. Skipjack fishing and oceanographic conditions. Prog. Rpt. Mie Pref. Fish. Expt. Sta. for 1927, pp. 15–17. [J] [P]
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1930c. Investigation of tuna fishing grounds and guidance in fishing. Prog. Rpt. Mie Pref. Fish. Expt. Sta. for 1927, pp. 18–33. [J] [P]
Albacore, big-eyed tuna, black tuna, yellowfin tuna: Japan; fishing conditions correlated with water temperature and specific gravity.

1930d. Investigation of skipjack fishing grounds and guidance in fishing. Prog. Rpt. Mie Pref. Fish. Expt. Sta. for 1928, pp. 1–18. [J] [P]
Japan; skipjack fishing conditions correlated with water temperature and specific gravity.

1930e. Investigation of tuna fishing grounds and guidance in fishing. Prog. Rpt. Mie Pref. Fish. Expt. Sta. for 1928, pp. 19–33. [J] [P]
Albacore, big-eyed tuna, black tuna, yellowfin tuna: Japan; fishing conditions correlated with water temperature and specific gravity.

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Frigate mackerel, skipjack, *Thunnus orientalis*, yellowfin tuna: melanophorhormone content of pituitary glands tabulated; proportional weights of various parts of *T. orientalis* brain; brain of yellowfin tuna figured.

MINE, TATSUZŌ, and SATORU IEHISA.

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Big-eyed tuna, black tuna, skipjack, yellowfin tuna: chemical analysis of liver and liver oil.

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Thunnus macropterus: South Seas; chemical analysis of various body parts; length-weight data, sex, and stomach contents of specimens recorded.

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Albacore, big-eyed tuna, black skipjack, black tuna, skipjack: chemical analyses of flesh and dark muscle.

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Auxis thazard, Thunnus orientalis: listed.

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ABBREVIATIONS USED

A. Hancock Pacific Exped.—Allan Hancock Pacific Expeditions. Los Angeles.

Acad. Nat. Sci. Phila., Monogr.—Academy of Natural Sciences of Philadelphia, Monographs. Philadelphia.

Act. Soc. Sci. Indo-Neerlandicae—Acta Societatis Scientarium Indo-Neerlandicae. Batavia.

Ann. and Mag. Nat. Hist.—The Annals and Magazine of Natural History. London.

Ann. New York Acad. Sci.—Annals of the New York Academy of Sciences. New York.

Ann. Rpt. Laguna Mar. Lab.—Annual Report of the Laguna Marine Laboratory. Claremont, California.

Annot. Zool. Jap.—Annotationes Zoologicae Japonenses. Tokyo.

Arch. Neêrlandaises Sci. Nat.—Archives Neêrlandaises des Sciences Exactes et Naturelles. Haarlem.

Australian Zool.—The Australian Zoologist. Sydney.

Bernice P. Bishop Mus. Occas. Papers—Bernice Pauahi Bishop Museum. Occasional Papers. Honolulu.

Biblio. Nederlandsch Indische Nat. Ver.—Bibliotheek van de Nederlandsch Indische Natuurhistorische Vereeniging. Batavia.

Biol. Bull. St. John's Univ.—Biological Bulletin of St. John's University. Shanghai.

Bull. American Mus. Nat. Hist.—Bulletin of the American Museum of Natural History. New York.

Bull. Bernice P. Bishop Mus.—Bulletin. Bernice Pauahi Bishop Museum. Honolulu.

Bull. Biogeog. Soc. Japan—Bulletin of the Biogeographical Society of Japan. Tokyo.

Bull. U. S. Bur. Fish.—Bulletin of the Bureau of Fisheries. United States Department of Commerce and Labor. Washington.

Bull. Japanese Soc. Sci. Fish.—Bulletin of the Japanese Society of Scientific Fisheries. Tokyo.

Bull. Pacific Sci. Fish. Inst.—Bulletins of the Pacific Scientific Fisheries Institute. Vladivostok.

Bull. Pacific Sci. Inst. Fish. and Oceanogr.—Bulletin of the Pacific Scientific Institute of Fisheries and Oceanography. Vladivostok.

Bull. Scripps Inst.—Bulletin. Scripps Institution for Biological Research. Berkeley.

Bull. So. Calif. Acad. Sci.—Bulletin of the Southern California Academy of Sciences. Los Angeles.

Bull. U. S. Fish Comm.—Bulletin of the United States Fish Commission. Washington.

Bur. Fish., Min. Agr. and For., Japanese Imp. Govt.—Bureau of Fisheries. Ministry of Agriculture and Forestry. Japanese Imperial Government. [Suisankyoku. Norinshō. Dai Nippon Teikoku Seifu.] Tokyo.

California Div. Fish and Game, Bur. Mar. Fish.—California Division of Fish and Game, Bureau of Marine Fisheries. San Francisco.

California Div. Fish and Game. Fish Bull.—California Division of Fish and Game. Fish Bulletin. Sacramento.

Cent. Fish. Expt. Sta. Rpt.—Central Fisheries Experiment Station Reports. [Suisan Shikenjō Chōsa Hōkoku.] Tokyo.

Com. Fish. Rev.—Commercial Fisheries Review. Fish and Wildlife Service. United States Department of the Interior. Washington.

Copeia—Copeia. New York.

Council Sci. and Indust. Res., Australia, Pamphlet—Council for Scientific and Industrial Research. Commonwealth of Australia. Pamphlet. Melbourne.

Dept. Fish., New South Wales—Department of Fisheries, New South Wales. Sydney.

Field Mus. Nat. Hist., Zool. Ser.—Field Museum of Natural History, Zoological Series. Chicago.

Fish. Div., FAO, UN.—Fisheries Division. The Food and Agriculture Organization of the United Nations. Washington.

Fish. Invest. (Suppl. Rpt.), Imp. Fish. Expt. Sta.—Fishery Investigation (Supplementary Report). Imperial Fisheries Experiment Station. Tokyo.

Fish. Res. Bd. Canada, Bull.—Fisheries Research Board of Canada, Bulletin. Vancouver.

Fish. Technol. Lect. Series—Fisheries Technology Lecture Series. [Suisan Seizō Kōgaku Kōza.] Tokyo.

Formosa Fish. Mag.—Formosa Fisheries Magazine. [Taiwan Suisan Zasshi.] Taihoku.

Formosa Govt.-Gen. Fish. Expt. Sta. Publ.—Formosa Government-General Fisheries Experiment Station. Publications. [Taiwan Sotokufu Suisan Shikenjō Shuppan.] Kiirun.

Ichth. Contrib. Internatl. Game Fish Assoc.—Ichthyological Contributions of the International Game Fish Association. New York.

Japanese Jour. Zool.—Japanese Journal of Zoology. Tokyo.

Jour. Acad. Nat. Sci. Phila.—Journal of the Academy of Natural Sciences of Philadelphia. Philadelphia.

Jour. Asiatic Soc. Bengal—Journal of the Asiatic Society of Bengal. Calcutta.

Jour. Biol. Chem.—Journal of Biological Chemistry. New York.

Jour. Coll. Agr., Imp. Univ. Tokyo—Journal of the College of Agriculture. Imperial University of Tokyo. Tokyo.

Jour. Coll. Sci., Imp. Univ. Tokyo—Journal of the College of Science. Imperial University of Tokyo. Tokyo.

Jour. Council Sci. and Indust. Res., Australia—Journal of the Council for Scientific and Industrial Research. Commonwealth of Australia. Melbourne.

Jour. Fac. Sci., Imp. Univ. Tokyo—Journal of the Faculty of Science, Imperial University of Tokyo. Tokyo.

Jour. Imp. Fish. Bur. Tokyo—Journal of the Imperial Fisheries Bureau. Tokyo.
Jour. Imp. Fish. Expt. Sta.—Journal of the Imperial Fisheries Experiment Station. Tokyo.
Jour. Mus. Godeffroy—Journal des Museum Godeffroy. Hamburg.
Jour. Pan-Pacific Res. Inst.—Journal of the Pan-Pacific Research Institution. Honolulu.

Mem. Bernice P. Bishop Mus.—Memoirs of the Bernice Pauahi Bishop Museum. Honolulu.
Mem. California Acad. Sci.—Memoirs of the California Academy of Sciences. San Francisco.
Mem. Carnegie Mus.—Memoirs of the Carnegie Museum. Pittsburgh.
Mid-Pacific Mag.—Mid-Pacific Magazine. Honolulu.
Miyagi Pref. Fish. Expt. Sta.—Miyagi Prefectural Fisheries Experiment Station. [Miyagi-ken Suisan Shikenjō. Watanoha.

Nat. Geneesk. Arch. Neêrland's Indië—Natuur en Geneeskundig Archief voor Neêrland's-Indië. Batavia.
Nat. Tijdschr. Nederlandsch-Indië—Natuurkundig Tijdschrift voor Nederlandsch-Indië. Batavia.
Nederlandsch Tijdschr. Dierk.—Nederlandsch Tijdschrift voor de Dierkunde. Amsterdam.
New Zealand Jour. Sci. Technol.—New Zealand Journal of Science and Technology. Wellington.
New Zealand Mar. Dept. Fish. Bull.—New Zealand Marine Department Fisheries Bulletin. Wellington.
Nissan Fish. Res. Sta. Odawara—Nissan Fisheries Research Station. [Nissan Suisan Kenkyūjō.] Odawara.
Note Serv. Océanogr. Pêches Indochine—Notes. Service Océanographique des Pêches de l'Indochine. Station Maritime de Cauda. Saigon.

Occas. Pap. California Acad. Sci.—Occasional Papers of the California Academy of Sciences. San Francisco.
Ocean. Fish.—Oceanic Fisheries. [Kaiyō Gyogyō.] Tokyo.

Pacific Biol. Sta., Fish. Res. Bd. Canada, Circ.—Pacific Biological Stations, Fisheries Research Board of Canada. Vancouver.
Pacific Sci.—Pacific Science. Honolulu.
Palao Trop. Biol. Sta. Studies—Palao Tropical Biological Station Studies. Tokyo.
Philippine Jour. Sci.—Philippine Journal of Science. Manila.
Proc. Acad. Nat. Sci. Phila.—Proceedings of the Academy of Natural Sciences of Philadelphia. Philadelphia.
Proc. California Acad. Sci.—Proceedings of the California Academy of Sciences. San Francisco.
Proc. Sci. Fish. Assoc.—Proceedings of the Scientific Fisheries Association. Tokyo.
Proc. Sixth Pacific Sci. Cong.—Proceedings of the Sixth Pacific Science Congress. Berkeley and Los Angeles.
Proc. U. S. Natl. Mus.—Proceedings of the United States National Museum. Washington.
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Prog. Rpt. Chiba Pref. Fish. Expt. Sta.—Progress Reports of the Chiba Prefectural Fisheries Experiment Station. [Chiba-ken Suisan Shikenjō Jigyō Hōkoku.] Tateyama.
Prog. Rpt. Chiba Pref. Fish. Expt. Sta., Katsuura Br.—Progress Reports of the Chiba Prefectural Fisheries Experiment Station, Katsuura Branch. [Chiba-ken Suisan Shikenjō Katsuura Bunjō Jigyo Hōkoku.] Katsuura.
Prog. Rpt. Formosa Govt.-Gen. Fish. Expt. Sta.—Progress Reports of the Formosa Government-General Fisheries Experiment Station [Taiwan Sotokufu Suisan Shikenjō; Jigyō Hōkoku; Shiken Hōkoku; Suisan Shiken Hōkoku.] Kiirun.
Prog. Rpt. Hokkaidō Fish. Expt. Sta.—Progress Reports of the Hokkaidō Fisheries Experiment Station. [Hokkaidō Suisan Shikenjō Suisan Chōsa Hōkoku.] Yoichi.
Prog. Rpt. Kagoshima Pref. Fish. Expt. Sta.—Progress Reports of the Kagoshima Prefectural Fisheries Experiment Station. [Kagoshima-ken Suisan Shikenjō Jigyō Hōkoku.] Kagoshima.
Prog. Rpt. Kōchi Pref. Fish. Expt. Sta.—Progress Reports of the Kōchi Prefectural Fisheries Experiment Station. [Kōchi-ken Suisan Shikenjō Jigyō Hōkoku.] Susaki.
Prog. Rpt. Kumamoto Pref. Fish. Expt. Sta.—Progress Reports of the Kumamoto Prefectural Fisheries Experiment Station. [Kumamoto-ken Suisan Shikenjō Jigyō Hōkoku.] Kumamoto.
Prog. Rpt. Mie Pref. Fish. Expt. Sta.—Progress Reports of the Mie Prefectural Fisheries Experiment Station. [Mie-ken Suisan Shikenjō Jigyō Hōkoku.] Tsu.
Prog. Rpt. Nagasaki Pref. Fish. Expt. Sta.—Progress Reports of the Nagasaki Prefectural Fisheries Experiment Station. [Nagasaki-ken Suisan Shikenjō Jigyō Hōkoku.] Nagasaki.
Prog. Rpt. Ōita Pref. Fish. Expt. Sta.—Progress Reports of the Ōita Prefectural Fisheries Experiment Station. [Ōita-ken Suisan Shikenjō Gyōmu Hōkoku.] Ōita.
Prog. Rpt. Okinawa Pref. Fish. Expt. Sta.—Progress Reports of the Okinawa Prefectural Fisheries Experiment Station. [Okinawa-ken Suisan Shikenjō: Jigyō Hōkoku; Seiseki; Seiseki Gaiyō.] Naha.
Prog. Rpt. Pacific Coast Sta., Fish. Res. Bd. Canada—Reports of the Pacific Coast Stations, Fisheries Research Board of Canada. Vancouver.
Prog. Rpt. Shizuoka Pref. Fish. Expt. Sta.—Progress Reports of the Shizouka Prefectural Fisheries Experiment Station. [Shizuoka-ken Suisan Shikenjō Jigyō Hōkoku.] Shimizu.
Prog. Rpt. South Seas Govt.-Gen. Fish. Expt. Sta.—Progress Reports of the South Seas Government-General Fisheries Experiment Station. [Nanyō-chō Suisan Shikenjō Jigyō Hōkoku.] Palau.
Prog. Rpt. Taihoku Prov. Fish. Expt. Sta.—Progress Reports of the Taihoku Province Fisheries Experiment Station. [Taihoku-shū Suisan Shikenjō Gyōmu Hōkoku.] Taihoku.
Prog. Rpt. Takao Prov. Fish. Expt. Sta.—Progress Reports of the Takao Province Fisheries Experiment Station. [Takao-shū Suisan Shiken Chōsa Hōkoku.] Takao.
Publ. Field Mus. Nat. Hist.—Publications. Field Museum of Natural History. Chicago.

Rec. Canterbury Museum—Records of the Canterbury Museum. Christchurch.
Rec. Oceanogr. Works—Records of Oceanographic Works in Japan. Tokyo.
Rec. So. Australian Mus.—Records of the South Australian Museum. Adelaide.
Rpt. British Assoc. Adv. Sci.—Report of the British Association for the Advancement of Science. London.
Rpt. U. S. Fish Comm.—Report of the Commissioner. United States Commission of Fish and Fisheries. Washington.

SCAP Nat. Resources Sec. Rpt.—Supreme Commander for the Allied Powers. General Headquarters. Natural Resources Section. Reports. Tokyo.
Sci. Sea—Science of the Sea. [Kaiyō no Kagaku.]
Sea and Sky—Sea and Sky. [Umi to Sora.] Kobe.
Semi-Ann. Rpt. Oceanogr. Invest.—Semi-Annual Report of Oceanographical Investigations. Tokyo.
Smithsn. Misc. Collect.—Smithsonian Miscellaneous Collections. Washington.
Soc. Prom. Ocean. Fish.—Society for the Promotion of Oceanic Fisheries. [Kaiyō Gyogyō Kyokai.] Tokyo.
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Stanford Univ. Publ., Univ. Ser., Biol. Sci.—Stanford University Publications, University Series, Biological Sciences. Stanford.

Tech. Educ. Ser. Technol. Mus., Sydney—Technical Education Series. Technological Museum. Sydney.
Text Fish.—The Text of the Fishery. Tokyo.
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Trav. Inst. Oceanogr. Indochine—Travaux de l'Institut Oceanographique de l'Indochine. Saigon.
Treubia—Treubia. Buitenzorg.

U. S. Fish and Wildlife Serv., Circ.—United States Department of the Interior, Fish and Wildlife Service, Circular. Washington.
U. S. Fish and Wildlife Serv. Fish. Bull.—United States Department of the Interior. Fishery Bulletin of the Fish and Wildlife Service. Washington.
U. S. Fish and Wildlife Serv., Fish. Leaf.—United States Department of the Interior. Fish and Wildlife Service, Fishery Leaflet. Washington.
U. S. Natl. Mus. Bull.—United States National Museum. Bulletin. Washington.
Univ. California Publ. Zool.—University of California Publications in Zoology. Berkeley.
Verh. Batavia Genoot. Kunst. Wetens.—Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschappen. Batavia.
Versl. Akad. Amsterdam—Verslagen van de Gewone Vergaderingen der Wis en Natuurkundige Afdeeling. Koninklijke Academie van Wetenschappen. Amsterdam.
Vidensk. Selskr. Skr.—Kongelige Danske Videnskabernes Selskab. Copenhagen.

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Herre and Umali, 1948.
Kishinouye, 1915a, 1923.
Nakamura, 1939b.
Okada and Matsubara, 1938.

Euthynnus yaito—Continued
Common names—Continued
Shapiro, 1948b.
Tominaga, 1943.
Compared with *Wanderer wallisi*
Whitley, 1937.
Description
Chevey, 1932a.
Kishinouye, 1915a, 1923.
Okada and Matsubara, 1938.
Tominaga, 1943.
Distribution
Chevey, 1932a, 1932b.
Domantay, 1940.
Eckles, 1949a.
Fraser-Brunner, 1949.
Fujita and Wakiya, 1915.
Godsil and Greenhood, 1948.
Herre, 1933, 1940.
Jordan and Evermann, 1926a.
Jordan and Hubbs, 1925.
Kishinouye, 1915a, 1922c, 1923.
Okada and Matsubara, 1938.
Schaefer, 1948c.
Shapiro, 1948b.
Smith and Schaefer, 1949.
Tominaga, 1943.
Figured
Chevey, 1932a.
Domantay, 1940.
Fraser-Brunner, 1949.
Kishinouye, 1915a, 1923.
Smith and Schaefer, 1949.
Food
Herald, 1949.
Kishinouye, 1923.
Tominaga, 1943.
Welsh, 1949.
Habits
Kishinouye, 1923.
Tominaga, 1943.
Keys
Brock, 1949.
Fraser-Brunner, 1949.
Kishinouye, 1915a, 1923.
Okada and Matsubara, 1938.
Measurement data
Bonham, 1946.
Parasites
Kishinouye, 1923.
Reproduction
Kishinouye, 1923.
Schaefer, 1948c.
Synonymy
Chevey, 1932a, 1934.
Fraser-Brunner, 1949.
Jordan and Hubbs, 1925.
Kishinouye, 1923.
Nakamura, 1939b.
Euthynnus yaito—Continued
Young
Kishinouye, 1919b, 1923, 1924.
Schaefer, 1948c.
Euthynnus alletteratus. See *Euthynnus alletteratus.*
Evolution
Based on internal anatomy
Kishinouye, 1919a.
Exploitation rates
Tauchi, 1940a, 1940b, 1940c.

Fishing conditions
Correlated with area
Hart and Hollister, 1947.
Hart et al., 1948.
Correlated with astronomical phenomena. See Astronomical phenomena.
Correlated with oceanography. See Oceanographic conditions.
Correlated with season
Hart et al., 1948.
Inanami, 1942b.
Whitehead, 1929.
Fishing grounds
Location correlated with oceanography. See Oceanographic conditions.
Food
Anonymous, 1938.
Asano, 1939.
Ban, 1941.
Bennett, 1840.
Chapman, 1946.
Clemens and Wilby, 1946.
Delsman and Hardenburg, 1934.
Eckles, 1949b.
Fitch, 1950.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Hart and Hollister, 1947.
Hart et al., 1948.
Hatai et al., 1941.
Herald, 1949.
Hildebrand, 1946.
Imamura, 1949.
Japanese Bur. Fish., 1934, 1939, 1940.
Jordan and Gilbert, 1881b, 1882.
Kanamura and Yazaki, 1940a, 1940b.
Kishinouye, 1895, 1915a, 1917b, 1923.
Kuronuma, 1940.
Marukawa, 1939.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura, 1936, 1943, 1949.
Nakamura Res. Staff, 1949.
Okuma, Imaizumi, and Maki, 1935.
Scagel, 1949.
Serventy, 1942a.
Shapiro, 1948a.
Starks, 1918.
Starks and Morris, 1907.
Suyehiro, 1936, 1938, 1942.
Taihoku Prov. Fish. Expt. Sta., 1928, 1929.

Food—Continued
Tinker, 1944.
Tominaga, 1943.
Walford, 1937.
Watanabe, H., 1939.
Welsh, 1949.
Whitley, 1937.
Yabe and Mori, 1948.

Germo alalunga. See *Thunnus germo.*
Germo alatunga. See *Thunnus germo.*
Germo albacores. See *Neothunnus itosibi.*
Germo argentivittatus. See *Neothunnus argentivittatus.*
Germo germo. See *Thunnus germo.*
Germo germon. See *Thunnus germo.*
Germo macropterus. See *Neothunnus macropterus.*
Germo sibi. See *Parathunnus sibi.*
Gravity, specific. See Specific gravity, also Oceanographic conditions.
Growth
Aikawa and Kato, 1938.
Brock, 1943.
Kimura, 1932, 1935.
Kishinouye, 1923.
Schaefer, 1948a, 1948b.
Gymnosarda affinis. See *Katsuwonus pelamis.*
Gymnosarda alletterata. See *Euthynnus alletteratus.*
Gymnosarda pelamis. See *Katsuwonus pelamis.*

Habits
Brock, 1949.
Imamura, 1949.
Jordan and Gilbert, 1882.
Kida, 1936.
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Roughly, 1916.
Schaefer, 1948b.
Serventy, 1942a.
Shapiro, 1948a.
Tinker, 1944.
Tominaga, 1943.
Uchida, 1923.
Uda, 1935b, 1940a.
Uda and Tsukushi, 1934.
Hermaphroditism
Nakamura, 1935.
Hormones
Migita and Arakawa, 1948.
Oya and Takahashi, 1936.
Toyama et al., 1941.

Juveniles. See Young.

Katsuwonidae
Anatomy
Kishinouye, 1917a, 1919a
Classification
Kishinouye, 1917a.
Compared with *Allothunnus fallai*
Serventy, 1948.
Katsuwonidae—Continued
Keys
Jordan and Hubbs, 1925.
Katsuwonus pelamis
Age
Aikawa, 1937.
Aikawa and Kato, 1938.
Higashi, 1941b.
Kimura, 1941.
Okamoto, 1940.
Yabe and Mori, 1948.
Anatomy
Eckles, 1949b.
Godsil and Byers, 1944.
Higashi, 1941a.
Imamura, 1949.
Kishinouye, 1915a, 1915b, 1918, 1919a, 1923.
Matsui, 1942a, 1942b.
Suyehiro, 1936, 1938, 1941, 1942.
Body condition
Aikawa, 1937.
Aikawa and Kato, 1938.
Ikebe and Matsumoto, 1937.
Onodera, 1941.
South Seas Govt.-Gen. Fish. Expt. Sta., 1941d.
Suyehiro, 1936, 1938.
Body temperature
Uda, 1941.
Watanabe, N., 1941.
Catch per unit of effort
Kanamura and Yazaki, 1940a, 1940b.
Chemical analysis
Higashi and Hirai, 1948.
Kodama, Iizuka, and Harada, 1934.
Miyama and Osakabe, 1938, 1940.
Miyauchi, 1915.
Okuda, 1918.
Classification
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Kishinouye, 1915a, 1923.
Nakamura, 1939b.
Okada and Matsubara, 1938.
Phillipps, 1927b.
Roedel, 1948b.
Shapiro, 1948a.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931.
Common names
Barnhart, 1936.
Craig, 1929.
Delsman and Hardenburg, 1934.
FAO, 1949.
Fish, 1948.
Fujita and Wakiya, 1915.
Herre and Umali, 1948.
Jordan and Evermann, 1896, 1905.
Jordan and Hubbs, 1925.

Katsuwonus pelamis—Continued
Common names—Continued
Jordan and Jordan, 1922.
Jordan and Snyder, 1901.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1939b.
Okada and Matsubara, 1938.
Phillipps, 1927b.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a, 1948b.
Smith, 1947.
Starks and Morris, 1907.
Tanaka, 1912.
Tinker, 1944.
Tominaga, 1943.
Utrey and Greeley, 1928.
Walford, 1931, 1937.
Whitley, 1947.
Compared with *Thynnus affinis*
Cantor, 1850.
Description
Barnhart, 1936.
Bennett, 1840.
Bleeker, 1856.
Boeseman, 1947.
Clemens and Wilby, 1946.
Cuvier and Valenciennes, 1934.
Delsman and Hardenburg, 1934.
Eigenmann and Eigenmann, 1890.
Fowler, 1928, 1938.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Günther, 1860, 1876.
Hildebrand, 1946.
Imamura, 1949.
Jordan and Evermann, 1905.
Kishinouye, 1915a, 1922b, 1923.
Lesson, 1830.
Macleay, 1881.
Meek and Hildebrand, 1923.
Nakamura, 1939b.
Okada and Matsubara, 1938.
Roedel, 1948b.
Seale, 1940.
Serventy, 1941.
Shapiro, 1948a.
Soldatov and Lindberg, 1930.
Stead, 1906.
Tanaka, 1912.
Temminck and Schlegel, 1850.
Tinker, 1944.
Tominaga, 1943.
Walford, 1931, 1937.
Distribution
Abe, 1939.
Anonymous, 1941.
Barnhart, 1936.

Katsuwonus pelamis—Continued
Distribution—Continued
Bleeker, 1856, 1860a, 1862, 1865a.
Chapman, 1946.
Clemens and Wilby, 1946.
Cuvier and Valenciennes, 1831.
Delsman and Hardenburg, 1934.
Domantay, 1940.
Eckles, 1949a.
Eigenmann, 1892.
Eigenmann and Eigenmann, 1890, 1891.
Evermann and Seale, 1907.
FAO, 1949.
Fish, 1948.
Fowler, 1928, 1931, 1934, 1938, 1944, 1949.
Fraser-Brunner, 1950.
Fujita and Wakiya, 1915.
Godsil and Greenhood, 1948.
Günther, 1860, 1876.
Herre, 1932, 1933, 1935, 1936, 1940.
Hildebrand, 1946.
Imamura, 1949.
Jenkins, 1903.
Jordan and Evermann, 1896, 1905.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Jordan and Seale, 1906.
Jordan and Snyder, 1901.
Jordan and Starks, 1907.
Jordan, Tanaka, and Snyder, 1913.
Kanamura and Yazaki, 1940a, 1940b.
Kimura, 1941, 1942b.
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Lesson, 1830.
Macleay, 1881.
Martin, 1938.
Matsubara, 1943.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1939b.
Nichols and Murphy, 1944.
Okada and Matsubara, 1938.
Okinawa Pref. Fish. Expt. Sta., 1943.
Phillipps, 1927a, 1927b.
Phillipps and Hodgkinson, 1922.
Reeves, 1928.
Richardson, 1846.
Roedel, 1948b.
Roughly, 1916.
Schaefer, 1948c.
Seale, 1940.
Serventy, 1941, 1947.
Shapiro, 1948a, 1948b.
Smith and Schaefer, 1949.
Soldatov and Lindberg, 1930.
South Seas Govt.–Gen. Fish. Expt. Sta., 1937a.
Starks and Morris, 1907.
Stead, 1906, 1908.
Tanaka, 1912, 1931.

Katsuwonus pelamis—Continued
Distribution—Continued
Taranetz, 1937.
Tinker, 1944.
Tominaga, 1943.
Ulrey, 1929.
Ulrey and Greeley, 1928.
Waite, 1907.
Walford, 1931, 1937.
Whitehead, 1929.
Whitley, 1947.
Distribution correlated with water temperature
Takayama, Ikeda, and Ando, 1934.
Uda, 1935b, 1936, 1940b.
Eggs
Hatai et al., 1941.
Marr, 1948.
Nakamura Res. Staff, 1949.
Yabe and Mori, 1948.
Enemies
Imamura, 1949.
Tinker, 1944.
Figured
Barnhart, 1936.
Clemens and Wilby, 1946.
Cuvier and Valenciennes, 1831.
Domantay, 1940.
Eckles, 1949a.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Jordan and Evermann, 1905.
Kishinouye, 1915a, 1923.
Kitahara, 1897.
Kumata et al., 1941.
Lesson, 1830.
McCulloch, 1922.
Nakamura, 1939b.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a.
Smith and Schaefer, 1949.
Tanaka, 1912.
Temminck and Schlegel, 1850.
Tinker, 1944.
Walford, 1931, 1937.
Fishing conditions correlated with oceanography
Aikawa, 1933.
Chiba Pref. Fish. Expt. Sta., Katsuura Br., 1936, 1937, 1938, 1941.
Formosa Govt.-Gen. Fish. Expt. Sta., 1930, 1931, 1932, 1933b, 1934.
Imamura, 1949.
Inanami, 1941, 1942d.
Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1926b, 1927b, 1928a, 1929a, 1930a, 1931a, 1932a, 1933a, 1935, 1936a, 1937.
Kanamura and Yazaki, 1940b.
Kawamura, 1939.
Kimura, 1941, 1949.
Kōchi Pref. Fish. Expt. Sta., 1923a.

Katsuwonus pelamis—Continued
Fishing conditions correlated with oceanography—Con.
Kumamoto Pref. Fish. Expt. Sta., 1946.
Mie Pref. Fish. Expt. Sta., 1930a, 1930b, 1930d.
Okinawa Pref. Fish. Expt. Sta., 1940a, 1943.
Sasaki, 1939a.
Shapiro, 1948a.
Shimamura, 1927.
Shizuoka Pref. Fish. Expt. Sta., 1936, 1937.
South Seas Govt.-Gen. Fish. Expt. Sta., 1937c, 1938, 1942, 1943b.
Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b, 1929, 1932.
Takayama, Ikeda, and Ando, 1934.
Uda, 1935b, 1938, 1939, 1940c.
Uehara, 1941.
Yabe and Mori, 1948.
Fishing conditions correlated with weather
Kanamura and Yazaki, 1940b.
Okinawa Pref. Fish. Expt. Sta., 1940a, 1943.
Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b.
Uda and Watanabe, 1938.
Food
Clemens and Wilby, 1946.
Delsman and Hardenburg, 1934.
Eckles, 1949b.
Hatai et al., 1941.
Hildebrand, 1946.
Imamura, 1949.
Kishinouye, 1917b, 1923.
Nakamura Res. Staff, 1949.
Shapiro, 1948a.
Suyehiro, 1936, 1938, 1942.
Taihoku Prov. Fish. Expt. Sta., 1928, 1929.
Tinker, 1944.
Tominaga, 1943.
Walford, 1937.
Yabe and Mori, 1948.
Growth
Aikawa and Kato, 1938.
Habits
Imamura, 1949.
Kishinouye, 1923.
Shapiro, 1948a.
Tinker, 1944.
Tominaga, 1943.
Uchida, 1923.
Uda, 1935b, 1940a.
Uda and Tsukushi, 1934.
Hermaphroditism
Nakamura, 1935.
Hormones
Migita and Arakawa, 1948.
Oya and Takahashi, 1936.
Toyama et al., 1941.
Keys
Brock, 1949.
Delsman and Hardenburg, 1934.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.

Katsuwonus pelamis—Continued
Keys—Continued
Hildebrand, 1946.
Kishinouye, 1915a, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931, 1937.
Length-weight relation
Bonham, 1946.
Measurement data
Aikawa and Kato, 1938.
Bonham, 1946.
Godsil and Byers, 1944.
Higashi, 1940a, 1940b, 1941a, 1941b, 1942.
Ikebe and Matsumoto, 1937.
Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1927b, 1928a, 1929a, 1936a, 1937, 1938a, 1939a, 1940a, 1941.
Kodama, Iizuka, and Harada, 1934.
Marr, 1948.
Nakamura Res. Staff, 1949.
Ōita Pref. Fish. Expt. Sta., 1925.
Okinawa Pref. Fish. Expt. Sta., 1931.
Onodera, 1941.
Schaefer, 1948b.
South Seas Govt.-Gen. Fish. Expt. Sta., 1941d.
Suyehiro, 1936, 1938.
Taihoku Prov. Fish. Expt. Sta., 1928, 1929.
Uda, 1941.
Watanabe, N., 1941.
Yabe and Mori, 1948.
Yamamoto, 1940.
Meristic characters
Godsil and Byers, 1944.
Nakamura Res. Staff, 1949.
Migration
Hatai et al., 1941.
Imamura, 1949.
Kimura, 1941, 1942b.
Kishinouye, 1923.
Matsubara, 1943.
Matsumoto, 1937.
Sasaki, 1939a.
Shapiro, 1948a, 1948b.
Tominaga, 1943.
Uda, 1936.
Walford, 1937.
Parasites
Bennett, 1840.
Harada, 1928.
Kishinouye, 1923.
Manter, 1940.
Van Cleave, 1940.
Populations
Aikawa, 1937.
Godsil and Byers, 1944.

Katsuwonus pelamis—Continued
Populations—Continued
Imamura, 1949.
Tauchi, 1941.
Tominaga, 1943.
Uda and Tsukushi, 1934.
Reproduction
Eckles, 1949b.
Hatai et al., 1941.
Imamura, 1949.
Kishinouye, 1923.
Marr, 1948.
Schaefer, 1948c.
Schaefer and Marr, 1948a.
Shapiro, 1948b.
Walford, 1937.
Yabe and Mori, 1948.
Sex ratio
Ikebe and Matsumoto, 1937.
Marr, 1948.
Nakamura Res. Staff, 1949.
Sexual dimorphism
Hatai et al., 1941.
Sexual maturity
Hatai et al., 1941.
Marr, 1948.
Matsubara, 1943.
Matsui, 1942b.
Nakamura Res. Staff, 1949.
Okinawa Pref. Fish. Expt. Sta., 1931.
Schaefer and Marr, 1948a.
Yabe and Mori, 1948.
Size composition
Aikawa, 1937.
Aikawa and Kato, 1938.
Inanami, 1942b.
Kagoshima Pref. Fish. Expt. Sta., 1937.
Kimura, 1941.
Nakamura Res. Staff, 1949.
Okamoto, 1940.
Sasaki, 1939a.
Uda, 1935b.
Uda and Tsukushi, 1934.
Yabe and Mori, 1948.
Swimming velocity
Watanabe, N., 1941.
Synonymy
Bleeker, 1856.
Boeseman, 1947.
Evermann and Seale, 1907.
FAO, 1949.
Fish, 1948.
Fowler, 1928, 1934, 1944, 1949.
Fraser-Brunner, 1950.
Günther, 1860, 1876.
Herre, 1936.
Hildebrand, 1946.
Jenkins, 1903.
Jordan and Evermann, 1896, 1905.
Jordan, Tanaka, and Snyder, 1913.

Katsuwonus pelamis—Continued
Synonymy—Continued
Kishinouye, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1939b.
Phillipps, 1927b.
Richardson, 1846.
Soldatov and Lindberg, 1930.
Tanaka, 1912, 1931.
Ulrey and Greeley, 1928.
Waite, 1907.
Tagging
Anonymous, 1939.
Fukuda and Iizuka, 1940b.
Godsil, 1938.
Kagoshima Pref. Fish. Expt. Sta., 1928a, 1936b, 1938b, 1939b, 1940b.
Matsumoto, 1937.
South Seas Govt.-Gen. Fish. Expt. Sta., 1941c.
Uda, 1936.
Young
Eckles, 1949b.
Hatai et al., 1941.
Inanami, 1942c.
Kishinouye, 1919b, 1923, 1924, 1926.
Marr, 1948.
Schaefer, 1948c.
Schaefer and Marr, 1948a.
Yabe and Mori, 1948.
Young as food of tuna
Kishinouye, 1917b.
Marukawa, 1939.
Katsuwonus pelamys. See *Katsuwonus pelamis*.
Katsuwonus vagans. See *Katsuwonus pelamis*.
Katwonus vagans. See *Katsuwonus pelamis*.
Keys
Brock, 1949.
Delsman and Hardenburg, 1934.
Fraser-Brunner, 1949, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Kishinouye, 1915a, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Wade, 1949.
Walford, 1931, 1937.
Kishinoella
Keys
Soldatov and Lindberg, 1930.
Kishinoella rara
Classification
Nakamura, 1939b.
Okada and Matsubara, 1938.
Common names
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Nakamura, 1939b.
Okada and Matsubara, 1938.
Compared with *Kishinoella zacalles*
Nakamura, 1939b.
Description
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Nakamura, 1939b.
Okada and Matsubara, 1938.
Distribution
Jordan and Evermann, 1926a, 1926b.
Jordan and Hubbs, 1925.
Nakamura, 1939b.
Okada and Matsubara, 1938.
Figured
Nakamura, 1939b.
Keys
Brock, 1949.
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.
Synonymy
Nakamura, 1939b.
Kishinoella tonggol
Anatomy
Serventy, 1942b.
Common names
Serventy, 1941.
Whitley, 1947.
Compared with *Kishinoella zacalles*
Serventy, 1942b.
Compared with *Neothunnus rarus*
Serventy, 1942b.
Compared with *Thunnus maccoyi*
Serventy, 1941.
Compared with *Thunnus nicolsoni*
Serventy, 1942b.
Compared with *Thunnus tonggol*
Serventy, 1942b.
Description
Serventy, 1941, 1942b.
Distribution
Serventy, 1941, 1942a, 1942b.
Whitley, 1947.
Figured
Serventy, 1941, 1942b.
Food
Serventy, 1942a.
Habits
Serventy, 1942a.
Keys
Serventy, 1941.
Length-weight relation
Serventy, 1941.

Kishinoella tonggol—Continued
Measurement data
Serventy, 1942b.
Reproduction
Serventy, 1942a.
Synonymy
Serventy, 1942b.
Kishinoella zacalles
Classification
Fraser-Brunner, 1950.
Nichols and LaMonte, 1941.
Compared with *Kishinoella rara*
Nakamura, 1939b.
Compared with *Kishinoella tonggol*
Serventy, 1942b.
Description
Fraser-Brunner, 1950.
Jordan and Evermann, 1926b.
Distribution
Fraser-Brunner, 1950.
Jordan and Evermann, 1926b.
Figured
Fraser-Brunner, 1950.
Jordan and Evermann, 1926b.
Keys
Fraser-Brunner, 1950.
Jordan and Evermann, 1926b.
Synonymy
Fraser-Brunner, 1950.

Length-weight data. See Morphometrics.

Mackerel, frigate. See *Auxis* spp.
Management
Schaefer, 1948c.
Maturity
Anonymous, 1938.
Ban, 1941.
Clark, 1929.
Hatai et al., 1941.
Ikebe, 1939.
Imaizumi, 1937.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Kato, 1940.
Marr, 1948.
Matsubara, 1943.
Matsui, 1942b.
Nakamura, 1938.
Nakamura Res. Staff, 1949.
Okinawa Pref. Fish. Expt. Sta., 1931.
Okuma, Imaizumi, and Maki, 1935.
Schaefer, 1948b.
Schaefer and Marr, 1948a.
Soc. Prom. Ocean. Fish., 1936.
Watanabe, H., 1939.
Measurement data. See Morphometrics.
Migration.
Cobb, 1919.
Hatai et al., 1941.
Migration—Continued
Imamura, 1949.
Kimura, 1941, 1942b.
Kishinouye, 1923.
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Matsubara, 1943.
Matsumoto, 1937.
Nakamura, 1943, 1949.
Sasaki, 1939a, 1939b.
Serventy, 1941.
Shapiro, 1948a, 1948b.
Soc. Prom. Ocean. Fish., 1936.
Tauchi, 1940b.
Tominaga, 1943.
Uda, 1936.
Walford, 1937.
Whitehead, 1931.
Morphometrics
Length-weight relation
Bonham, 1946.
Hiratsuka and Morita, 1935.
Schaefer, 1948a.
Serventy, 1941.
Measurement data
Aikawa and Kato, 1938.
Anonymous, 1938.
Bonham, 1946.
Brock, 1943, 1949.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Godsil, 1948.
Godsil and Byers, 1944.
Higashi, 1940a, 1940b, 1941a, 1941c, 1942.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Ikebe, 1939, 1940a, 1940b, 1940c, 1941a, 1941b.
Ikebe and Matsumoto, 1937.
Inanami, 1940a.
Japanese Bur. Fish., 1939, 1940.
Kagoshima Pref. Fish. Expt. Sta., 1925, 1926a, 1927b, 1928a, 1929a, 1936a, 1937, 1938a, 1939a, 1940a, 1941.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Kodama, Iizuka, and Harada, 1934.
Marr, 1948.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura, 1936, 1939a, 1939b.
Nakamura Res. Staff, 1949.
Ōita Pref. Fish. Expt. Sta., 1925, 1927a, 1927b, 1930.
Okinawa Pref. Fish. Expt. Sta., 1931.
Okuma, Imaizumi, and Maki, 1935.
Onodera, 1941.
Schaefer, 1948a, 1948b.
Serventy, 1942b, 1948.
South Seas Govt.-Gen. Fish. Expt. Sta., 1941d, 1943a.
Suyehiro, 1936, 1938.
Taihoku Prov. Fish. Expt. Sta., 1928, 1929.
Uda, 1932, 1941.
Uno, 1936b.
Wade, 1949.
Watanabe, Hajime, 1939.

Morphometrics—Continued
Measurement data—Continued
Watanabe, Haruo, 1940.
Watanabe, N., 1941.
Yabe and Mori, 1948.
Yamamoto, 1940.
Meristic characters
Clark, 1929.
Godsil and Byers, 1944.
Nakamura Res. Staff, 1949.
Schaefer and Marr, 1948b.
Wade, 1949.
Methods of measurement
Godsil, 1948.
Godsil and Byers, 1944.
Marr and Schaefer, 1949.
Sex ratio
Brock, 1943.
Ikebe and Matsumoto, 1937.
Marr, 1948.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura Res. Staff, 1949.

Neothunnus
Compared with *Sematthunnus*
Fowler, 1933.
Nakamura, 1939a.
New species recorded
Jordan and Evermann, 1926a.
Neothunnus albacora
Classification
Nichols and LaMonte, 1941.
Common names
Nichols and LaMonte, 1941.
Description
Nichols and LaMonte, 1941.
Keys
Nichols and LaMonte, 1941.
Synonymy
Nichols and LaMonte, 1941.
Neothunnus albacora albacora. See *Neothunnus albacora.*
Neothunnus albacora macropterus. See *Neothunnus macropterus.*
Neothunnus allisoni
Classification
Nichols and LaMonte, 1941.
Common names
Nichols and LaMonte, 1941.
Compared with *Neothunnus macropterus*
Walford, 1937.
Description
Nichols and LaMonte, 1941.
Keys
Nichols and LaMonte, 1941.
Synonymy
Nichols and LaMonte, 1941.
Neothunnus allisoni allisoni. See *Neothunnus allisoni.*
Neothunnus allisoni itosibi. See *Neothunnus itosibi.*
Neothunnus argentivittatus
Common names
Nichols and Murphy, 1922.
Description
Nichols and Murphy, 1922.
Distribution
Fowler, 1944.
Jordan and Jordan, 1922.
Nichols and Murphy, 1922.
Neothunnus catalinae
Classification
Nichols and LaMonte, 1941.
Common names
Craig, 1929.
Nichols and LaMonte, 1941.
Description
Jordan and Evermann, 1926b.
Nichols and LaMonte, 1941.
Distribution
Jordan and Evermann, 1926b.
Ulrey, 1929.
Figured
Jordan and Evermann, 1926b.
Keys
Jordan and Evermann, 1926b.
Nichols and LaMonte, 1941.
Synonymy
Nichols and LaMonte, 1941.
Neothunnus itosibi
Classification
Nichols and LaMonte, 1941.
Okada and Matsubara, 1938.
Common names
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.
Compared with *Neothunnus macropterus*
Nakamura, 1939a, 1939b.
Description
Fowler, 1928.
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.
Powell, 1937.
Distribution
Domantay, 1940.
Fowler, 1928.
Jordan and Evermann, 1926b.
Martin, 1938.
Okada and Matsubara, 1938.
Powell, 1937.
Figured
Domantay, 1940.
Jordan and Evermann, 1926b.
Powell, 1937.
Keys
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.
Synonymy
Fowler, 1928.
Powell, 1937.

Neothunnus macropterus
Age
Aikawa and Kato, 1938.
Ban, 1941.
Higashi, 1941b.
Ikebe, 1939, 1940a, 1940b, 1940c, 1941a, 1941b.
Kanamura and Yazaki, 1940a, 1940b.
Kimura, 1942a.
Schaefer, 1948b.
Tauchi, 1940b.
Anatomy
Fish, 1948.
Godsil and Byers, 1944.
Higashi, 1941c.
Kishinouye, 1915a, 1915b, 1919a, 1922a, 1923.
Matsui, 1942a.
Migita and Arakawa, 1948.
Nakamura, 1949.
Suyehiro, 1941, 1942.
Body condition
Aikawa and Kato, 1938.
Ikebe, 1939.
Kanamura and Yazaki, 1940a, 1940b.
Body temperature
Anonymous, 1938.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Nakamura, 1941.
Ōita Pref. Fish. Expt. Sta., 1927a, 1930.
Catch per unit of effort
Formosa Govt.-Gen. Fish Expt. Sta., 1933a.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Imaizumi, 1937.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Nakamura, 1949.
Okuma, Imaizumi, and Maki, 1935.
Chemical analysis
Dill, 1921.
Higashi and Hirai, 1948.
Miyama and Osakabe, 1940.
Miyama, Saruya, and Hasegawa, 1939.
Classification
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Kishinouye, 1915a, 1923.
Nakamura, 1939a, 1939b, 1943, 1949.
Nichols and LaMonte, 1941.
Okada and Matsubara, 1938.
Roedel, 1948b.
Schaefer, 1948a.
Shapiro, 1948a.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931.
Common names
Barnhart, 1936.
Delsman and Hardenburg, 1934.

Neothunnus macropterus—Continued
Common names—Continued
FAO, 1949.
Fish, 1948.
Fujita and Wakiya, 1915.
Herre and Umali, 1948.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Jordan and Snyder, 1901.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a, 1948b.
Smith, 1947.
Starks and Morris, 1907.
Tinker, 1944.
Ulrey and Greeley, 1928.
Walford, 1931, 1937.
Whitley, 1947.
Compared with *Neothunnus allisoni*
Walford, 1937.
Compared with *Neothunnus itosibi*
Nakamura, 1939a, 1939b.
Compared with *Parathunnus mebachi*
Roedel, 1948b.
Compared with *Semathunnus guildi*
Nakamura, 1939b.
Compared with *Thunnus thynnus*
Thompson and Higgins, 1919.
Description
Barnhart, 1936.
Boeseman, 1947.
Delsman and Hardenburg, 1934.
Fowler, 1928.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Jordan and Starks, 1907.
Kishinouye, 1915a, 1923.
Matsubara, 1943.
Nakamura, 1939b, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Seale, 1940.
Serventy, 1941.
Shapiro, 1948a.
Soldatov and Lindberg, 1930.
Starks, 1918.
Temminck and Schlegel, 1850.
Thompson and Higgins, 1919.
Tinker, 1944.
Walford, 1931, 1937.

Neothunnus macropterus—Continued
Distribution
Abe, 1939.
Anonymous, 1938.
Barnhart, 1936.
Bleeker, 1852, 1862, 1865a.
Chapman, 1946.
Chu, 1931.
Delsman and Hardenburg, 1934.
Domantay, 1940.
Eckles, 1949a.
FAO, 1949.
Fish, 1948.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Fowler, 1923a, 1928, 1931, 1938, 1949.
Fraser-Brunner, 1950.
Fujita and Wakiya, 1915.
Godsil and Greenhood, 1948.
Herre, 1932, 1935, 1936, 1940.
Hildebrand, 1946.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Holder, 1912.
Hubbs, 1916.
Imaizumi, 1937.
Japanese Bur. Fish., 1934.
Jordan and Evermann, 1926a, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Jordan and Seale, 1906.
Jordan and Snyder, 1901.
Jordan and Starks, 1907.
Jordan, Tanaka, and Snyder, 1913.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Kimura, 1942b.
Kishinouye, 1915a, 1923.
Kōchi Pref. Fish. Expt. Sta., 1923b, -924.
Kumata et al., 1941.
Martin, 1938.
Matsubara, 1943.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Okuma, Imaizumi, and Maki, 1935.
Reeves, 1928.
Richardson, 1846.
Roedel, 1948b.
Schaefer, 1948c.
Seale, 1940.
Serventy, 1941.
Shapiro, 1948a, 1948b.
Smith and Schaefer, 1949.
Soldatov and Lindberg, 1930.
South Seas Govt.-Gen. Fish. Expt. Sta., 1937a.
Starks, 1918.
Starks and Morris, 1907.
Takao Prov. Fish. Expt. Sta., 1927.
Tanaka, 1931.
Taranetz, 1937.
Temminck and Schlegel, 1850.

Neothunnus macropterus—Continued
Distribution—Continued
Tinker, 1944.
Ulrey, 1929.
Ulrey and Greeley, 1928.
Walford, 1931, 1937.
Whitley, 1928, 1947.
Distribution correlated with water temperature
Takayama and Ando, 1934.
Uda, 1935a.
Exploitation rates
Tauchi, 1940b.
Figured
Anonymous, 1938.
Barnhart, 1936.
Delsman and Hardenburg, 1934.
Domantay, 1940.
Eckles, 1949a.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Jordan and Evermann, 1926b.
Jordan and Starks, 1907.
Kishinouye, 1915a, 1923.
Kitahara, 1897.
Kumata et al., 1941.
Nakamura, 1949.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a.
Starks, 1918.
Temminck and Schlegel, 1850.
Tinker, 1944.
Walford, 1931, 1937.
Fishing conditions correlated with astronomical phenomena
Takao Prov. Fish. Expt. Sta., 1927.
Fishing conditions correlated with oceanography
Aikawa, 1933.
Ban, 1941.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Ikebe, 1940d, 1942.
Inanami, 1940b, 1940c, 1941, 1942d.
Japanese Bur. Fish., 1934.
Kagoshima Pref. Fish. Expt. Sta., 1926b, 1927a, 1928b, 1929b, 1930b, 1930c, 1931b, 1932b, 1933b.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Kawamura, 1939.
Kimura, 1942a.
Kimura and Ishii, 1933.
Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
Nakamura, 1949.
Ōita Pref. Fish. Expt. Sta., 1930.
Okuma, Imaizumi, and Maki, 1935.
Shapiro, 1948a.
South Seas Govt.-Gen. Fish. Expt. Sta., 1937a, 1938, 1941b, 1942, 1943b.
Takao Prov. Fish Expt. Sta., 1927.

Neothunnus macropterus—Continued
Fishing conditions correlated with oceanography—Con.
Takayama and Ando, 1934.
Uehara, 1941.
Fishing conditions correlated with weather
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Kanamura and Yazaki, 1940a, 1940b.
Ōita Pref. Fish. Expt. Sta., 1930.
Okuma, Imaizumi, and Maki, 1935.
Food
Anonymous, 1938.
Ban, 1941.
Chapman, 1946.
Fitch, 1950.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Herald, 1949.
Hildebrand, 1946.
Japanese Bur. Fish., 1934.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Kishinouye, 1917b, 1923.
Marukawa, 1939.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura, 1936, 1943, 1949.
Okuma, Imaizumi, and Maki, 1935.
Shapiro, 1948a.
Suyehiro, 1942.
Tinker, 1944.
Walford, 1937.
Growth
Aikawa and Kato, 1938.
Kimura, 1932, 1935.
Kishinouye, 1923.
Schaefer, 1948a, 1948b.
Habits
Kishinouye, 1923.
Nakamura, 1949.
Schaefer, 1948b.
Shapiro, 1948a.
Hormones
Migita and Arakawa, 1948.
Toyama et al., 1941.
Keys
Brock, 1949.
Delsman and Hardenburg, 1934.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Jordan and Evermann, 1926b.
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931, 1937.

Neothunnus macropterus—Continued
Length-weight relation
Hiratsuka and Morita, 1935
Schaefer, 1948a.
Measurement data
Aikawa and Kato, 1938.
Anonymous, 1938.
Bonham, 1946.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Godsil, 1948.
Godsil and Byers, 1944.
Higashi, 1940a, 1941b, 1941c, 1942.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Ikebe, 1939, 1940a, 1940b, 1940c, 1941a, 1941b.
Inanami, 1940a.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a, 1940b.
Marr, 1948.
Miyama, Saruya, and Hasegawa, 1939.
Nakamura, 1936, 1939a, 1939b.
Ōita Pref. Fish. Expt. Sta., 1925, 1927a, 1927b, 1930.
Okuma, Imaizumi, and Maki, 1935.
Schaefer, 1948a, 1948b.
South Seas Govt.-Gen. Fish. Expt. Sta., 1943a.
Watanabe, H., 1940.
Meristic characters
Godsil and Byers, 1944.
Migration
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Nakamura, 1943.
Shapiro, 1948a.
Tauchi, 1940b.
Walford, 1937.
Parasites
Kishinouye, 1923.
Populations
Godsil, 1948, 1949.
Godsil and Byers, 1944.
Tauchi, 1940b.
Reproduction
Hatai et al., 1941.
Ikebe, 1941b.
Kishinouye, 1923.
Marr, 1948.
Nakamura, 1939b, 1943, 1949.
Schaefer, 1948c.
Schaefer and Marr, 1948a.
Tinker, 1944.
Walford, 1937.
Sex ratio
Marr, 1948.
Miyama, Saruya, and Hasegawa, 1939.
Sexual maturity
Anonymous, 1938.
Ban, 1941.
Hatai et al., 1941.
Ikebe, 1939.
Imaizumi, 1937.
Kanamura and Imaizumi, 1935.

Neothunnus macropterus—Continued
Sexual maturity—Continued
Kanamura and Yazaki, 1940a, 1940b.
Kato, 1940.
Marr, 1948.
Okuma, Imaizumi, and Maki, 1935.
Schaefer, 1948b.
Schaefer and Marr, 1948a.
Size composition
Aikawa and Kato, 1938.
Kimura, 1932, 1942a.
Schaefer, 1948b.
Schaefer and Marr, 1948a.
Tauchi, 1940b.
Survival rates
Tauchi, 1940b.
Synonymy
Boeseman, 1947.
Chu, 1931.
FAO, 1949.
Fish, 1948.
Fowler, 1928, 1931, 1949.
Fraser-Brunner, 1950.
Herre, 1936.
Hildebrand, 1946.
Jordan and Hubbs, 1925.
Jordan and Starks, 1907.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1923.
Nakamura, 1939a, 1939b, 1949.
Richardson, 1846.
Soldatov and Lindberg, 1930.
Tanaka, 1931.
Ulrey and Greeley, 1928.
Tagging
Godsil, 1938.
Young
Kishinouye, 1924, 1926.
Schaefer, 1948c.
Schaefer and Marr, 1948a.
Neothunnus rarus
Anatomy
Kishinouye, 1915a, 1915b, 1923.
Nakamura, 1949.
Classification
Kishinouye, 1915a, 1923.
Nakamura, 1943, 1949.
Nichols and LaMonte, 1941.
Common names
Delsman and Hardenburg, 1934.
Kishinouye, 1915a, 1923.
Nakamura, 1943, 1949.
Nichols and LaMonte, 1941.
Compared with *Kishinoella tonggol*
Serventy, 1942b.
Description
Delsman and Hardenburg, 1934.
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Nichols and LaMonte, 1941.
Neothunnus rarus—Continued
Distribution
Delsman and Hardenburg, 1934.
Herre, 1940.
Kishinouye, 1915a, 1923.
Nakamura, 1943, 1949.
Eggs
Delsman and Hardenburg, 1934.
Figured
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Food
Kishinouye, 1923.
Nakamura, 1943, 1949.
Habits
Kishinouye, 1923.
Nakamura, 1949.
Keys
Delsman and Hardenburg, 1934.
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Nichols and LaMonte, 1941.
Migration
Nakamura, 1943.
Reproduction
Delsman and Hardenburg, 1934.
Nakamura, 1943.
Synonymy
Kishinouye, 1923.
Nakamura, 1949.
Nichols and LaMonte, 1941.
Neothunnus rarus zacalles. See *Kishinoella zacalles.*
Neothunnus tonggol
Description
Jordan and Evermann, 1926b.
Distribution
Jordan and Evermann, 1926b.
Keys
Jordan and Evermann, 1926b.
Synonymy
Jordan and Evermann, 1926b.
Neothynnus macropterus. See *Neothunnus macropterus.*
Nicotinic acid
Higashi and Hirai, 1948.
Nomenclature, tuna. See Tuna, common names.

Oceanographic conditions. See also Currents; Salinity; Specific gravity; Tides; Water.
Correlated with fishing
Ban, 1941.
Formosa Govt.-Gen. Fish. Expt. Sta., 1933a.
Hiratsuka and Imaizumi, 1934.
Hiratsuka and Ito, 1934.
Ikebe, 1942.
Imamura, 1949.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940b.
Kawamura, 1939.
Kōchi Pref. Fish. Expt. Sta., 1923a.
Nakamura, 1949.

Oceanographic conditions—Continued
Correlated with fishing—Continued
Ōita Pref. Fish. Expt. Sta., 1930.
Okuma, Imaizumi, and Maki, 1935.
Scagel, 1949.
Shapiro, 1948a.
South Seas Govt.-Gen. Fish. Expt. Sta., 1937c, 1938, 1941b.
Taihoku Prov. Fish. Expt. Sta., 1927a, 1927b.
Uda, 1935b, 1940c.
Correlated with location of fishing grounds
Inanami, 1942a.
Soc. Prom. Ocean. Fish., 1936.
Orcynus. See Thunnidae.
Orcynus alalonga. See *Thunnus germo*.
Orcynus germo. See *Thunnus germo*.
Orcynus pacificus. See *Thunnus germo*.

Parasites
Bennett, 1840.
Harada, 1928.
Kishinouye, 1923.
Manter, 1940.
Van Cleave, 1940.
Parathunnus
Keys
Soldatov and Lindberg, 1930.
Parathunnus mebachi
Anatomy
Godsil and Byers, 1944.
Higashi, 1941c.
Kishinouye, 1915a, 1915b, 1918, 1919a, 1922a, 1923.
Nakamura, 1949.
Body temperature
Kanamura and Imaizumi, 1935.
Ōita Pref. Fish. Expt. Sta., 1927a, 1930.
Catch per unit of effort
Imaizumi, 1937.
Japanese Bur. Fish., 1939.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a.
Nakamura, 1949.
Chemical analysis
Miyama and Osakabe, 1940.
Miyauchi, 1915.
Classification
Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1943, 1949.
Common names
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1939b, 1943, 1949.
Compared with *Neothunnus macropterus*
Roedel, 1948b.
Compared with *Thunnus germo*
Roedel, 1948b.
Description
Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1949.
Parathunnus mebachi—Continued
Distribution
Fish, 1948.
Imaizumi, 1937.
Japanese Bur. Fish., 1934.
Kanamura and Imaizumi, 1935.
Kanamura and Yazaki, 1940a.
Kimura, 1942b.
Kishinouye, 1915a, 1923.
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Kumata et al., 1941.
Matsubara, 1943.
Nakamura, 1939b, 1943, 1949.
Takao Prov. Fish. Expt. Sta., 1927.
Distribution correlated with water temperatures
Takayama and Ando, 1934.
Figured
Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Kumata et al., 1941.
Nakamura, 1949.
Fishing conditions correlated with astronomical phenomena
Takao Prov. Fish. Expt. Sta., 1927.
Fishing conditions correlated with oceanography
Aikawa, 1933.
Fukuda and Iizuka, 1940a.
Ikebe, 1942.
Inanami, 1940b, 1940c, 1942d.
Japanese Bur. Fish., 1934, 1939.
Kagoshima Pref. Fish. Expt. Sta., 1926b, 1927a, 1928b, 1929b, 1930b, 1930c, 1931b, 1932b, 1933b.
Kanamura and Imaizumi, 1935.
Kimura, 1942a.
Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
Nakamura, 1949.
Ōita Pref. Fish Expt. Sta., 1930.
Okinawa Pref. Fish. Expt. Sta., 1940b.
Ōmori and Fujimoto, 1940.
Ōmori and Fukuda, 1938, 1940.
South Seas Govt.-Gen. Fish. Expt. Sta., 1942.
Takao Prov. Fish. Expt. Sta., 1927.
Takayama and Ando, 1934.
Uehara, 1941.
Fishing conditions correlated with weather
Kanamura and Imaizumi, 1935.
Ōita Pref. Fish. Expt. Sta., 1930.
Food
Kishinouye, 1917b, 1923.
Nakamura, 1943, 1949.
Habits
Kishinouye, 1923.
Nakamura, 1949.
Keys
Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Measurement data
Godsil and Byers, 1944.
Higashi, 1940a, 1941c.

Parathunnus mebachi—Continued
Measurement data—Continued
Ikebe, 1940a.
Kanamura and Imaizumi, 1935.
Ōita Pref. Fish. Expt. Sta., 1925, 1927a, 1927b, 1930.
Watanabe, H., 1940.
Meristic characters
Godsil and Byers, 1944.
Migration
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Nakamura, 1943.
Parasites
Kishinouye, 1923.
Reproduction
Nakamura, 1943.
Sexual maturity
Kanamura and Imaizumi, 1935.
Synonymy
Kishinouye, 1923.
Nakamura, 1939b, 1949.
Young
Hatai et al., 1941.
Kishinouye, 1926.
Young as food of tunas
Kishinouye, 1917b.
Parathunnus sibi
Anatomy
Suyehiro, 1941, 1942.
Chemical analysis
Miyama and Osakabe, 1938.
Classification
Okada and Matsubara, 1938.
Common names
Jordan and Hubbs, 1925.
Jordan and Snyder, 1901.
Okada and Matsubara, 1938.
Shapiro, 1948b.
Tinker, 1944.
Ulrey and Greeley, 1928.
Compared with *Pelamys sibi*
Bleeker, 1879.
Compared with *Thynnus alalonga*
Temminck and Schlegel, 1850.
Description
Brock, 1949.
Fowler, 1927, 1928.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Okada and Matsubara, 1938.
Temminck and Schlegel, 1850.
Tinker, 1944.
Distribution
Domantay, 1940.
Fowler, 1927, 1928, 1929, 1931, 1938, 1949.
Herre, 1940.
Jordan and Evermann, 1926a, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Jordan and Snyder, 1901.
Parathunnus sibi—Continued
Distribution—Continued
Okada and Matsubara, 1938.
Richardson, 1846.
Shapiro, 1948b.
Smith and Schaefer, 1949.
Snyder, 1904.
Tanaka, 1931.
Tinker, 1944.
Ulrey, 1929.
Ulrey and Greeley, 1928.
Distribution correlated with water temperature
Uda, 1935a.
Figured
Domantay, 1940.
Fowler, 1927, 1928.
Jordan and Evermann, 1926b.
Kitahara, 1897.
Temminck and Schlegel, 1850.
Tinker, 1944.
Food
Suyehiro, 1942.
Habits
Brock, 1949.
Hormones
Toyama et al., 1941.
Keys
Brock, 1949.
Jordan and Evermann, 1926b.
Okada and Matsubara, 1938.
Measurement data
Brock, 1949.
Higashi, 1942.
Synonymy
Fowler, 1928, 1949.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Richardson, 1846.
Tanaka, 1931.
Ulrey and Greeley, 1928.
Young as food of tunas
Marukawa, 1939.
Parathynnus sibi. See *Parathunnus sibi*.
Pelamys affine. See *Euthynnus alletteratus*.
Pelamys macropterus. See *Neothunnus macropterus*.
Pelamys pelamys. See *Katsuwonus pelamis*.
Pelamys sibi
Compared with *Thynnus sibi*
Bleeker, 1879.
Pelamys thunnina. See *Euthynnus alletteratus*.
Plecostei
Anatomy
Berg, 1947.
Kishinouye, 1917a.
Takahashi, 1924.
Classification
Berg, 1947.
Kishinouye, 1917a.
Takahashi, 1924, 1926.

Populations
Aikawa, 1937.
Brock, 1943.
Clark, 1929.
Godsil, 1948, 1949.
Godsil and Byers, 1944.
Imamura, 1949.
Tauchi, 1940a, 1940b, 1940c, 1941.
Tominaga, 1943.
Uda and Tokunaga, 1937.
Uda and Tsukushi, 1934.

Reproduction
Brock, 1943.
Delsman and Hardenburg, 1934.
Eckles, 1949b.
Hatai et al., 1941.
Ikebe, 1941b.
Imamura, 1949.
Kishinouye, 1915a, 1923.
Marr, 1948.
Nakamura, 1938, 1939b, 1943, 1949.
Schaefer, 1948c.
Schaefer and Marr, 1948a.
Serventy, 1941, 1942a.
Shapiro, 1948b.
Soc. Prom. Ocean. Fish., 1936.
Tinker, 1944.
Walford, 1937.
Watanabe, H., 1939.
Whitehead, 1931.
Yabe and Mori, 1948.

Salinity. See also Oceanographic conditions.
Correlated with fishing
Inanami, 1941.
Uda and Tokunaga, 1937.
Scomber taso. See *Auxis taso*.
Semathunnus
Compared with *Neothunnus*
Fowler, 1933.
Nakamura, 1939a.
Semathunnus guildi
Compared with *Neothunnus macropterus*
Nakamura, 1939b.
Description
Fowler, 1933.
Distribution
Fowler, 1934.
Synonymy
Fowler, 1934.
Semathunnus itosibi
Common names
Tinker, 1944.
Description
Tinker, 1944.
Distribution
Fowler, 1934.
Tinker, 1944.
Synonymy
Fowler, 1934.

Sex. See Morphometrics.
Sexual maturity. See Maturity.
Size composition
Aikawa, 1937.
Aikawa and Kato, 1938.
Brock, 1943.
Hart et al., 1948.
Inanami, 1942b.
Kagoshima Pref. Fish. Expt. Sta., 1937.
Kawana, 1934.
Kida, 1936.
Kimura, 1932, 1935, 1941, 1942a.
Mine and Iehisa, 1940.
Nakamura Res. Staff, 1949.
Okamoto, 1940.
Sasaki, 1939a, 1939b.
Scagel, 1949.
Schaefer, 1948b.
Schaefer and Marr, 1948a.
Serventy, 1941, 1947.
Tauchi, 1940a, 1940b, 1940c.
Uda, 1935b.
Uda and Tsukushi, 1934.
Yabe and Mori, 1948.
Skipjack. See *Katsuwonus pelamis*.
Skipjack, black. See *Euthynnus* spp.
Spawning. See Reproduction.
Specific gravity
Correlated with fishing
Formosa Govt.-Gen. Fish. Expt. Sta., 1930, 1931, 1932, 1933b, 1934.
Japanese Bur. Fish., 1939, 1940.
Mie Pref. Fish. Expt. Sta., 1930a, 1930b, 1930c, 1930d, 1930e.
Ōmori and Fujimoto, 1940.
Ōmori and Fukuda, 1938, 1940.
Shimamura, 1927.
Taihoku Prov. Fish. Expt. Sta., 1929.
Stock. See Populations.
Stomach contents. See Food.
Survival rates
Tauchi, 1940a, 1940b, 1940c.
Synonymy
Bleeker, 1852, 1856.
Boeseman, 1947.
Chevey, 1932a, 1934.
Chu, 1931.
Evermann and Seale, 1907.
FAO, 1949.
Fish, 1948.
Fowler, 1904b, 1928, 1931, 1934, 1938, 1944, 1949.
Fraser-Brunner, 1949, 1950.
Griffin, 1927.
Günther, 1860, 1876.
Herre, 1936.
Hildebrand, 1946.
Jenkins, 1903.
Jordan, 1923.
Jordan and Evermann, 1896, 1905, 1926b.
Jordan and Gilbert, 1882.

Synonymy—Continued
Jordan and Hubbs, 1925.
Jordan and Starks, 1907.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1923.
Lütken, 1880.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1939a, 1939b, 1949.
Nichols and LaMonte, 1941.
Phillipps, 1927b.
Powell, 1937.
Richardson, 1846.
Schultz, 1949.
Schultz and DeLacy, 1936.
Serventy, 1942b.
Soldatov and Lindberg, 1930.
Tanaka, 1912, 1931.
Ulrey and Greeley, 1928.
Wade, 1949.
Waite, 1907, 1921.
Weber, 1913,
Whitley, 1937.

Tagging
Anonymous, 1939.
Fukuda and Iizuka, 1940b.
Godsil, 1938.
Kagoshima Pref. Fish. Expt. Sta., 1928a, 1936b, 1938b, 1939b, 1940b.
Kawana, 1934.
Matsumoto, 1937.
Scagel, 1949.
South Seas Govt.-Gen. Fish. Expt. Sta., 1941c.
Uda, 1936.
Temperature. See Body temperature; Water temperature; also Oceanographic conditions.
Thunnidae
Anatomy
Kishinouye, 1917a, 1919a.
Classification
Jordan, 1923.
Kishinouye, 1917a.
Lütken, 1880.
Distribution
Bleeker, 1844.
Keys
Jordan and Hubbs, 1925.
Synonymy
Jordan, 1923.
Lütken, 1880.
Thunniformes. See Plecostei.
Thunnus alalunga. See *Thunnus germo*.
Thunnus albacora. See *Neothunnus macropterus*.
Thunnus germo
Age
Aikawa and Kato, 1938.
Brock, 1943.
Ikebe, 1940c.
Kanamura and Yazaki, 1940b.
Kimura, 1942a.
Thunnus germo—Continued
Age—Continued
Tauchi, 1940c.
Uno, 1936b.
Anatomy
Bennett, 1840.
Fish, 1948.
Godsil and Byers, 1944.
Kishinouye, 1915a, 1915b, 1919a, 1922a, 1923.
Nakamura, 1949.
Suyehiro, 1941.
Body condition
Aikawa and Kato, 1938.
Kanamura and Yazaki, 1940b.
Soc. Prom. Ocean. Fish., 1936.
Body temperature
Anonymous, 1938.
Kanamura and Yazaki, 1940b.
Ōita Pref. Fish. Expt. Sta., 1927a.
Scagel, 1949.
Catch per unit of effort
Imaizumi, 1937.
Japanese Bur. Fish., 1939, 1940.
Kanamura and Yazaki, 1940a, 1940b.
Nakamura, 1949.
Chemical analysis
Dill, 1921.
Miyauchi, 1915.
Soc. Prom. Ocean. Fish., 1936.
Classification
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Phillipps, 1927b.
Roedel, 1948b.
Shapiro, 1948a.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931.
Common names
Barnhart, 1936.
Craig, 1929.
FAO, 1949.
Fish, 1948.
Fujita and Wakiya, 1915.
Herre and Umali, 1948.
Jordan and Evermann, 1896, 1905.
Jordan and Hubbs, 1925.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Phillipps, 1927b.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a, 1948b.
Smith, 1947.
Starks and Morris, 1907.

Thunnus germo—Continued
Common names—Continued
Tinker, 1944.
Ulrey and Greeley, 1928.
Walford, 1931, 1937.
Compared with *Parathunnus mebachi*
Roedel, 1948b.
Description
Barnhart, 1936.
Bennett, 1840.
Boeseman, 1947.
Clemens and Wilby, 1946.
Cooper, 1863.
Cuvier and Valenciennes, 1831.
Fowler, 1904b, 1928.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Griffin, 1927.
Günther, 1860, 1876.
Jordan and Evermann, 1905, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Kishinouye, 1915a, 1923.
Meek and Hildebrand, 1923.
Nakamura, 1939b, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a.
Soldatov and Lindberg, 1930.
Starks, 1918.
Stead, 1906.
Tinker, 1944.
Walford, 1931, 1937.
Distribution
Anonymous, 1938.
Barnhart, 1936.
Brock, 1939.
Clemens and Wilby, 1946.
Cooper, 1863.
Cowan, 1938.
Cuvier and Valenciennes, 1831.
Eigenmann, 1892.
Eigenmann and Eigenmann, 1891.
FAO, 1949.
Fish, 1948.
Fowler, 1904a, 1923b, 1928, 1931, 1938, 1944.
Fraser-Brunner, 1950.
Fujita and Wakiya, 1915.
Gilbert and Starks, 1904.
Godsil and Greenhood, 1948.
Griffin, 1927.
Günther, 1860, 1876.
Herre, 1940.
Hildebrand, 1946.
Holder, 1912.
Hubbs, 1928.
Imaizumi, 1937.
Japanese Bur. Fish., 1939, 1940.
Jordan, 1885.

Thunnus germo—Continued
Distribution—Continued
Jordan and Evermann, 1896, 1905, 1926a, 1926b.
Jordan and Gilbert, 1881a, 1882.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Jordan and Seale, 1906.
Jordan, Tanaka, and Snyder, 1913.
Kanamura and Yazaki, 1940b.
Kimura, 1942b.
Kishinouye, 1915a, 1923.
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Matsubara, 1943.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Metz, 1912.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Phillipps, 1927a, 1927b.
Phillipps and Hodgkinson, 1922.
Roedel, 1948b.
Roughly, 1916.
Sampson, 1940.
Schaefer, 1948c.
Schultz and DeLacy, 1936.
Serventy, 1941, 1947.
Shapiro, 1948a, 1948b.
Soldatov and Lindberg, 1930.
Starks, 1918.
Starks and Morris, 1907.
Stead, 1906, 1908.
Tanaka, 1931.
Taranetz, 1937.
Thompson and Higgins, 1919.
Tinker, 1944.
Ulrey, 1929.
Ulrey and Greeley, 1928.
Walford, 1931, 1937.
Whitehead, 1929.
Distribution correlated with water temperature
Takayama and Ando, 1934.
Uda, 1935a.
Eggs
Watanabe, H., 1939.
Enemies
Bennett, 1840.
Exploitation rates
Tauchi, 1940c.
Figured
Anonymous, 1938.
Barnhart, 1936.
Clemens and Wilby, 1946.
Cooper, 1863.
Fowler, 1904a.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Griffin, 1927.
Günther, 1876.
Holder, 1912.
Jordan and Evermann, 1905, 1926b.

Thunnus germo—Continued
Figured—Continued
Kishinouye, 1915a, 1923.
Kitahara, 1897.
Nakamura, 1949.
Roedel, 1948b.
Serventy, 1941.
Shapiro, 1948a.
Tinker, 1944.
Walford, 1931, 1937.
Fishing conditions correlated with area
Hart and Hollister, 1947.
Hart et al., 1948.
Fishing conditions correlated with oceanography
Aikawa, 1933.
Chiba Pref. Fish. Expt. Sta., Katsuura Br., 1936, 1941.
Hart and Hollister, 1947.
Hart et al., 1948.
Inanami, 1942d.
Japanese Bur. Fish., 1939, 1940.
Kagoshima Pref. Fish. Expt. Sta., 1927a, 1928b, 1930b, 1930c, 1931b, 1932b, 1932c, 1933b.
Kanamura and Yazaki, 1940b.
Kimura, 1942a, 1949.
Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
Nakamura, 1949.
Sasaki, 1939b.
Scagel, 1949.
Shapiro, 1948a.
Takayama and Ando, 1934.
Uda, 1940c.
Uda and Tokunaga, 1937.
Fishing conditions correlated with season
Hart et al., 1948.
Fishing grounds correlated with oceanography
Soc. Prom. Ocean. Fish., 1936.
Food
Anonymous, 1938.
Asano, 1939.
Bennett, 1840.
Clemens and Wilby, 1946.
Hart and Hollister, 1947.
Hart et al., 1948.
Japanese Bur. Fish., 1939, 1940.
Jordan and Gilbert, 1881b, 1882.
Kanamura and Yazaki, 1940b.
Kishinouye, 1917b, 1923.
Kuronuma, 1940.
Nakamura, 1943, 1949.
Scagel, 1949.
Shapiro, 1948a.
Starks, 1918.
Starks and Morris, 1907.
Walford, 1937.
Watanabe, H., 1939.
Growth
Aikawa and Kato, 1938.
Brock, 1943.
Kishinouye, 1923.

Thunnus germo—Continued
Habits
Jordan and Gilbert, 1882.
Kishinouye, 1923.
Nakamura, 1949.
Shapiro, 1948a.
Hormones
Toyama et al., 1941.
Keys
Brock, 1949.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Jordan and Evermann, 1926b.
Kishinouye, 1915a, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1949.
Okada and Matsubara, 1938.
Roedel, 1948b.
Serventy, 1941.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931, 1937.
Measurement data
Aikawa and Kato, 1938.
Anonymous, 1938.
Brock, 1943.
Godsil, 1948.
Godsil and Byers, 1944.
Ikebe, 1940c.
Japanese Bur. Fish., 1939, 1940.
Kanamura and Yazaki, 1940b.
Ōita Pref. Fish. Expt. Sta., 1925, 1927a.
South Seas Govt.- Gen. Fish. Expt. Sta., 1943a.
Uno, 1936b.
Watanabe, H. 1939.
Meristic characters
Clark, 1929.
Godsil and Byers, 1944.
Migration
Cobb, 1919.
Kimura, 1942b.
Kishinouye, 1923.
Kōchi Pref. Fish. Expt. Sta., 1923b, 1924.
Nakamura, 1943, 1949.
Sasaki, 1939b.
Shapiro, 1948a.
Soc. Prom. Ocean. Fish., 1936.
Walford, 1937.
Populations
Brock, 1943.
Clark, 1929.
Godsil, 1948, 1949.
Godsil and Byers, 1944.
Tauchi, 1940c.
Uda and Tokunaga, 1937.
Reproduction
Brock, 1943.
Nakamura, 1943.

Thunnus germo—Continued
Reproduction—Continued
Schaefer, 1948c.
Soc. Prom. Ocean. Fish., 1936.
Walford, 1937.
Watanabe, H., 1939.
Sex ratio
Brock, 1943.
Sexual maturity
Anonymous, 1938.
Clark, 1929.
Kanamura and Yazaki, 1940b.
Soc. Prom. Ocean. Fish., 1936.
Watanabe, H., 1939.
Size composition
Aikawa and Kato, 1938.
Brock, 1943.
Hart et al., 1948.
Kimura, 1942a.
Sasaki, 1939b.
Scagel, 1949.
Tauchi, 1940c.
Survival rates
Tauchi, 1940c.
Synonymy
Boeseman, 1947.
FAO, 1949.
Fish, 1948.
Fowler, 1904b, 1928.
Fraser-Brunner, 1950.
Griffin, 1927.
Günther, 1860, 1876.
Jordan and Evermann, 1896, 1905, 1926b.
Jordan and Gilbert, 1882.
Jordan and Hubbs, 1925.
Jordan, Tanaka, and Snyder, 1913.
Kishinouye, 1923.
McCulloch, 1922.
Meek and Hildebrand, 1923.
Nakamura, 1939b, 1949.
Phillipps, 1927b.
Schultz and DeLacy, 1936.
Soldatov and Lindberg, 1930.
Tanaka, 1931.
Ulrey and Greeley, 1928.
Tagging
Scagel, 1949.
Young
Kishinouye, 1917b, 1919b, 1923.
Lütken, 1880.
Schaefer, 1948c.
Thunnus maccori. See *Thunnus maccoyi.*
Thunnus maccoyi
Catch per unit of effort
Serventy, 1947.
Classification
Roughly, 1916.
Common names
Serventy, 1941.
Whitley, 1947.
Thunnus maccoyi—Continued
Compared with *Kishinoella tonggol*
Serventy, 1941.
Description
Castelnau, 1872.
Jordan and Evermann, 1926b.
Macleay, 1881.
Roughly, 1916.
Serventy, 1941.
Stead, 1908.
Distribution
Jordan and Evermann, 1926b.
Lord, 1927.
Macleay, 1881.
McCulloch, 1922.
Roughly, 1916.
Serventy, 1941, 1947.
Stead, 1908.
Waite, 1928.
Whitley, 1947.
Figured
McCulloch, 1922.
Roughly, 1916.
Serventy, 1941.
Habits
Roughly, 1916.
Keys
Jordan and Evermann, 1926b.
McCulloch, 1922.
Serventy, 1941.
Length-weight relation
Serventy, 1941.
Migration
Serventy, 1941.
Reproduction
Serventy, 1941.
Size composition
Serventy, 1941, 1947.
Synonymy
Jordan and Evermann, 1926b.
McCulloch, 1922.
Thunnus macropterus. See *Neothunnus macropterus.*
Thunnus maculatus
Distribution
Holder, 1912.
Figured
Holder, 1912.
Thunnus mebachi. See *Parathunnus mebachi.*
Thunnus nicolsoni
Compared with *Kishinoella tonggol*
Serventy, 1942b.
Thunnus obesus. See also *Parathunnus mebachi* and *Parathunnus sibi.*
Classification
Fraser-Brunner, 1950.
Description
Fraser-Brunner, 1950.
Distribution
Fraser-Brunner, 1950.

Thunnus obesus—Continued
Figured
Fraser-Brunner, 1950.
Keys
Fraser-Brunner, 1950.
Synonymy
Fraser-Brunner, 1950.
Thunnus orientalis
Age
Aikawa and Kato, 1938.
Kimura, 1935.
Tauchi, 1940a.
Anatomy
Kishinouye, 1915a, 1915b, 1919a, 1921, 1922a, 1923.
Migita and Arakawa, 1948.
Nakamura, 1938, 1949.
Suyehiro, 1942.
Body condition
Aikawa and Kato, 1938.
Body temperature
Ōita Pref. Fish. Expt. Sta., 1927a, 1930.
Chemical analysis
Miyama and Osakabe, 1938, 1940.
Miyauchi, 1915.
Shimizu, 1947.
Classification
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Shapiro, 1948a.
Common names
Fujita and Wakiya, 1915.
Jordan and Hubbs, 1925.
Jordan and Snyder, 1901.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Shapiro, 1948a, 1948b.
Tinker, 1944.
Compared with *Thunnus thynnus*
Kishinouye, 1921.
Soc. Prom. Ocean. Fish., 1936.
Tinker, 1944.
Description
Boeseman, 19-.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1949.
Okada and Matsubara, 1938.
Shapiro, 1948a.
Temminck and Schlegel, 1850.
Tinker, 1944.
Distribution
Fowler, 1934.
Fujita and Wakiya, 1915.
Jordan and Evermann, 1926a, 1926b.
Jordan and Hubbs, 1925.
Jordan and Jordan, 1922.
Thunnus orientalis—Continued
Distribution—Continued
Jordan and Snyder, 1900, 1901.
Kimura, 1942b.
Kishinouye, 1915a, 1923.
Kōchi Pref. Fish. Expt. Sta., 1924.
Matsubara, 1943.
Mori, 1928.
Nakamura, 1938, 1939b, 1943, 1949.
Okada and Matsubara, 1938.
Reeves, 1928.
Richardson, 1846.
Shapiro, 1948a, 1948b.
Tinker, 1944.
Distribution correlated with water temperature
Takayama and Ando, 1934.
Eggs
Hatai et al., 1941.
Nakamura, 1938, 1949.
Enemies
Kishinouye, 1923.
Exploitation rates
Tauchi, 1940a.
Figured
Kishinouye, 1915a, 1923.
Nakamura, 1939b, 1949.
Otaki, Fujita, and Higurashi, 1903.
Shapiro, 1948a.
Tinker, 1944.
Fishing conditions correlated with astronomical phenomena
Kawana, 1934.
Fishing conditions correlated with oceanography
Aikawa, 1933.
Fukuda and Iizuka, 1940a.
Iehisa, 1939.
Kagoshima Pref. Fish. Expt. Sta., 1927a, 1930c, 1932b.
Kawana, 1934, 1937.
Mie Pref. Fish. Expt. Sta., 1930c, 1930e.
Ōita Pref. Fish. Expt. Sta., 1930.
Okinawa Pref. Fish. Expt. Sta., 1940b.
Ōmori and Fujimoto, 1940.
Ōmori and Fukuda, 1938, 1940.
Shapiro, 1948a.
Takayama and Ando, 1934.
Uda, 1940c.
Fishing conditions correlated with weather
Ōita Pref. Fish. Expt. Sta., 1930.
Food
Kishinouye, 1923.
Nakamura, 1943, 1949.
Shapiro, 1948a.
Suyehiro, 1942.
Growth
Aikawa and Kato, 1938.
Kimura, 1932.
Kishinouye, 1923.
Habits
Kishinouye, 1923.
Nakamura, 1949.
Shapiro, 1948a.

Thunnus orentalis—Continued
Hormones
Migita and Arakawa, 1948.
Keys
Brock, 1949.
Jordan and Evermann, 1926b.
Kishinouye, 1915a, 1923.
Nakamura, 1949.
Okada and Matsubara, 1938.
Measurement data
Aikawa and Kato, 1938.
Higashi, 1940a.
Ōita Pref. Fish. Expt. Sta., 1927a, 1930.
Migration
Kimura, 1942b.
Kishinouye, 1923.
Kōchi Pref. Fish. Expt. Sta., 1924.
Nakamura, 1943, 1949.
Shapiro, 1948a.
Populations
Tauchi, 1940a.
Reproduction
Hatai et al., 1941.
Kishinouye, 1915a, 1923.
Nakamura, 1938, 1939b, 1943, 1949.
Soc. Prom. Ocean. Fish., 1936.
Sexual maturity
Hatai et al., 1941.
Nakamura, 1938.
Size composition
Aikawa and Kato, 1938.
Kawana, 1934.
Kimura, 1932, 1935.
Mine and Iehisa, 1940.
Tauchi, 1940a.
Survival rates
Tauchi, 1940a.
Synonymy
Boeseman, 1947.
Fowler, 1934.
Jordan and Evermann, 1926b.
Jordan and Hubbs, 1925.
Kishinouye, 1923.
Nakamura, 1939b, 1949.
Richardson, 1846.
Tagging
Kawana, 1934.
Young
Kishinouye, 1919b, 1923.
Thunnus phillippsi
Classification
Phillipps, 1927b.
Common names
Phillipps, 1927b.
Description
Jordan and Evermann, 1926b.
Distribution
Jordan and Evermann, 1926b.
Phillipps, 1927b.
Figured
Jordan and Evermann, 1926b.
Thunnus orentalis—Continued
Keys
Jordan and Evermann, 1926b.
Synonymy
Phillipps, 1927b.
Thunnus phillipsi. See *Thunnus phillippsi.*
Thunnus rarus. See *Neothunnus rarus.*
Thunnus salicns
Common names
Craig, 1929.
Description
Jordan and Evermann, 1926b.
Distribution
Jordan and Evermann, 1926b.
Ulrey, 1929.
Figured
Jordan and Evermann, 1926b.
Keys
Jordan and Evermann, 1926b.
Thunnus schlegeli. See *Thunnus orientalis.*
Thunnus thunnina. See *Euthynnus alletteratus.*
Thunnus thunnus. See *Thunnus thynnus.*
Thunnus thynnus
Anatomy
Fish, 1948.
Godsil and Byers, 1944.
Kishinouye, 1921.
Catch per unit of effort
Whitehead, 1931.
Chemical analysis
Dill, 1921.
Classification
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Roedel, 1948b.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931.
Whitehead, 1931.
Common names
Barnhart, 1936.
FAO, 1949.
Fish, 1948.
Jordan and Evermann, 1896.
Jordan, Tanaka, and Snyder, 1913.
Roedel, 1948b.
Schultz, 1949.
Starks and Morris, 1907.
Tinker, 1944.
Ulrey and Greeley, 1928.
Walford, 1931, 1937.
Compared with *Neothunnus macropterus*
Thompson and Higgins, 1919.
Compared with *Thunnus orientalis*
Kishinouye, 1921.
Soc. Prom. Ocean. Fish., 1936.
Tinker, 1944.
Description
Barnhart, 1936.
Fowler, 1928, 1944.
Fraser-Brunner, 1950.

Thunnus thynnus—Continued
Description—Continued
Godsil and Byers, 1944.
Günther, 1876.
Meek and Hildebrand, 1923.
Roedel, 1948b.
Soldatov and Lindberg, 1930.
Starks, 1918.
Stead, 1906.
Tinker, 1944.
Walford, 1931, 1937.
Distribution
Abe, 1939.
Barnhart, 1936.
Brock, 1938.
FAO, 1949.
Fish, 1948.
Fowler, 1923a, 1923b, 1928, 1929, 1931, 1934, 1938, 1944.
Fraser-Brunner, 1950.
Gilbert and Starks, 1904.
Günther, 1876.
Herre, 1936, 1940.
Hildebrand, 1946.
Holder, 1912.
Jordan and Evermann, 1896.
Jordan and Jordan, 1922.
Jordan, Tanaka, and Snyder, 1913.
Meek and Hildebrand, 1923.
Metz, 1912.
Roedel, 1948b.
Schultz, 1949.
Schultz and DeLacey, 1936.
Soldatov, 1929.
Soldatov and Lindberg, 1930.
Starks, 1918.
Starks and Morris, 1907.
Stead, 1906.
Tanaka, 1931.
Taranetz, 1937.
Tinker, 1944.
Ulrey, 1929.
Ulrey and Greeley, 1928.
Waite, 1921.
Walford, 1931, 1937.
Whitehead, 1929, 1931.
Distribution correlated with water temperature
Uda, 1935á.
Enemies
Tinker, 1944.
Walford, 1937.
Figured
Barnhart, 1936.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Holder, 1912.
Kitahara, 1897.
Roedel, 1948b.
Soldatov and Lindberg, 1930.
Starks, 1918.
Tinker, 1944.
Thunnus thynnus—Continued
Figured—Continued
Walford, 1931, 1937.
Whitehead, 1931.
Fishing conditions correlated with oceanography
Kida, 1936.
Food
Tinker, 1944.
Walford, 1937.
Habits
Kida, 1936.
Uchida, 1923.
Keys
Brock, 1949.
Fraser-Brunner, 1950.
Godsil and Byers, 1944.
Hildebrand, 1946.
Meek and Hildebrand, 1923.
Roedel, 1948b.
Soldatov and Lindberg, 1930.
Taranetz, 1937.
Walford, 1931, 1937.
Measurement data
Godsil and Byers, 1944.
Uda, 1932.
Meristic characters
Godsil and Byers, 1944.
Migration
Whitehead, 1931.
Populations
Godsil and Byers, 1944.
Reproduction
Tinker, 1944.
Walford, 1937.
Whitehead, 1931.
Size composition
Kida, 1936.
Synonymy
FAO, 1949.
Fish, 1948.
Fowler, 1928, 1934, 1944.
Fraser-Brunner, 1950.
Günther, 1876.
Herre, 1936.
Jordan and Evermann, 1896.
Jordan, Tanaka, and Snyder, 1913.
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